Stormwater Runoff Management and Synergistic Water Quality Planning related to Proposed Major Projects in the 2004 Regional Transportation Plan

A Report for the CalTrans Environmental Analysis Section

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1. INTRODUCTION

This report was prepared by the Southern California Association of Governments (SCAG) and the University of California at Santa Barbara (UCSB) for the Stormwater Group in the Environmental Analysis section of California Department of Transportation (CalTrans) in response to recent concerns that water quality protection, stormwater runoff management and regional transportation planning activities need to become more fully integrated. These concerns reflect the view that integrated transportation planning will, over the long-term, be more protective of the environment and cost-effective. With the use of this integrated approach in new projects it is expected that the need for future costly retrofit measures can be minimized.

At the present time, stormwater permits are defined by political jurisdictions, not by watershed or hydrology areas. However, the impact of requirements appearing in new stormwater permits are such that compliance measures are now seen by water quality planners as favoring "regional solutions" rather than city-by-city solutions. Given the need for fiscal efficiency and wider public awareness of water problems in our ecosystem, future stormwater regulations are expected to be applied in new ways. Rather than permits issued according to county and city boundaries, it can be expected that stormwater permits will be organized within watershed or hydrologic boundaries.

In the meantime, and in preparation for this change, it is advantageous for transportation and water quality planners to have information that assists local governments and others in this more complex and evolving planning environment. Each transportation project, along with other local projects, now needs to understand its position within its watershed, an area shared with other jurisdictions and stakeholders. This responsibility will undoubtedly put new demands on the intergovernmental processes between jurisdictions, especially when so many other factors create competing interests and goals.

The expense associated with permit compliance, along with the scarcity of local fiscal resources, underscores the need for new levels of cooperative planning and implementation among local entities. In earlier stormwater permits when compliance requirements were less stringent, stand-alone city compliance efforts could be justified. Now, with new pressures impacting local governments, this strategy is less convincing. As a result, those cities that appreciate the new terms of success are using a mantra that says, "Together we can invest more wisely and be better stewards of our environment".

The information in this report is intended to contribute to these kinds of collaborative water quality planning. With integration of information it will be possible to identify the "natural" partners for better transportation and growth planning in the various watersheds of the SCAG region. These new partnerships will be better positioned to work within natural conditions to both reduce existing water quality impairments and to prevent future impairments.

Along with suggesting an intergovernmental approach for more integrated water quality initiatives, this report features potential water quality and stormwater management impacts that may be created by proposed major projects in SCAG's 2004 Regional Transportation Plan (RTP). This environmental analysis furthers a CalTrans commitment to make environmental and pollution management strategies an integral part of the regional transportation planning process. This movement towards integrated planning will bring many benefits. For example, regional policy makers and other members of the public will be able to make decisions that better respect environmental stewardship, support improved environmental sustainability and manage resources more cost-effectively.

The analysis is presented in a summary section for the entire SCAG area (Section 2), as well as individual sections for each of the six counties located within the SCAG area (Sections 3 through 8). Each county section presents case studies for watersheds that are impaired or may be impacted by the proposed RTP projects. Conclusions and recommendations are presented in Section 9. Appendix A presents the methods and data sets used in this analysis.

2. OVERVIEW OF THE SCAG AREA

2.1 Watersheds within the SCAG Area

The SCAG area is comprised of six counties: Los Angeles, Ventura, Riverside, Orange, San Bernardino and Imperial (Figure 2.1). The map also indicates the large variations in topography within the SCAG area, with sloping, coastal mountain ranges and very flat, low desert areas inland. Figure 2.2 presents the 187 cities within the SCAG area. A listing of all the cities within SCAG, by County, is provided in Appendix B. Cities within each county are presented in subsequent sections. Clearly, with so many potential players in the area, coordinated approaches to water quality management are needed. In addition to these local agencies, there are a number of Federal, State, County and special districts that participate to some extent in managing water resources in the SCAG area and that are potential partners for developing coordinated water solutions.

There are 35 watersheds in the SCAG area, as presented in Figure 2.3. The figure provides both the name of the watershed and its US Geological Survey Hydrologic Unit Code (HUC). Appendix C lists all the cities within the SCAG area and corresponding watersheds. Figure 2.4 presents the subwatersheds or Hydrologic Subunits (HSU) within the SCAG area, as determined by the National Hydrographic System. The first digit of the HSU relates to the Regional Water Quality Control Board (RWQCB) that has jurisdiction over the HSU. The correspondence between HSUs and SCAG counties is also available in Appendix E. In addition, Appendix F provides a reference between Cities and HSU. Note that many cities in the SCAG area occupy more than one HSU, since jurisdictional boundaries are usually unrelated to watershed or subwatershed boundaries. This means that usually more than one city has an impact on any given HSU. Figure 2.5 illustrates the complexity of the river and tributary network for the watersheds in the SCAG area, according to the National Hydrographic Dataset.

There are several RWQCBs that have jurisdiction within the SCAG area (Figure 2.6). The primary ones are RB4 Los Angeles RWQCB, RB7 Colorado Basin RWQCB, and RB8 Santa Ana RWQCB. However, since watershed boundaries do not coincide with counties, the following other regional boards also have jurisdiction over some of the subwatersheds in the SCAG area: RB3 Central Coast RWQCB, RB5 Central Valley RWQCB, RB6 Lahontan RWQCB, and RB9 San Diego RWQCB.

There are several important watershed characteristics that are of interest regarding potential RTP projects, but in particular precipitation and soil type have a strong influence on the potential for stormwater runoff. In addition, the percent imperviousness of a particular land-use type will have a significant effect on stormwater runoff. For the proposed RTP projects, the roadway is considered an impervious surface, which will channel all the precipitation runoff towards collection points, where it is either treated or discharged into stormwater drains. Since the soil surface is mostly covered, it plays less of a role in determining pollutant loading, but in many cases the road surface serves as a channel for eroded particles coming from the surrounding soils.

Annual precipitation throughout the SCAG area is low, except near the San Bernardino Mountains (Figure 2.7). In most areas, annual precipitation is less than 16 inches per year (in/yr), rising to 40-50 in/yr only in the mountainous areas, mostly the San Bernardino Mountains. Precipitation (rain and snowfall) is mostly within the winter months (Dec-Mar), with little precipitation throughout the rest of the year (Figure 2.8). The majority of the precipitation in the SCAG area is during a few storm events, as exemplified in Figure 2.9 for Newhall in the Santa Clara River watershed.

Soils are classified by the Natural Resource Conservation Service into four Hydrologic Soil Groups based on the soil's runoff potential (NRCS, 1975). Group A includes sand, loamy sand or sandy loam soils. They have low runoff potential and high infiltration rates even when thoroughly wetted. Group B comprises silt loams or loams, with moderate infiltration rates when thoroughly wetted. Group C soils are sandy clay loams, which have a slower infiltration rate than Group B and generally consist of moderately fine to fine-textured soils, with potential for runoff when wet. Group D soils are clay loams, silty clay loams, sandy clays, silty clays or clays, which have a very slow infiltration rate and high runoff potential when thoroughly wet. Dominant soil classifications by land use for each county and watershed are presented in Table 2.1.

Table 2.1 Dominant soil type for each watershed, by landuse

Watersheds	HUC	HD res	LD res	Comm	Ind	Ag	Grass/ Pasture	Forest/ Vacant
Aliso-San Onofre	18070301	B	B	B	B	B	D	D
Antelope-Fremont Valleys	18090206	A	A	A	A	A	B	A
Calleguas	18070103	D	D	D	D	D	D	D
Coyote-Cuddeback Lakes	18090207	B	B	B	A	A	C	A
Imperial Reservoir	15030104	D	D	D	D	D	D	D
Los Angeles	18070105	B	B	B	B	B	B	B
Lower Colorado	15030107	B	B	B	B	B	B	A
Mojave	18090208	B	B	B	A	A	C	A
Newport Bay	18070204	B	B	B	B	B	C	D
Salton Sea	18100200	B	B	B	B	A	B	A
San Gabriel	18070106	B	B	B	B	B	C	D
San Jacinto	18070202	C	C	B	C	A	B	D
Santa Ana	18070203	B	B	B	A	A	C	A
Santa Clara	18070102	B	B	B	B	B	B	D
Santa Margarita	18070302	C	C	B	C	A	B	D
Santa Monica Bay	18070104	B	B	B	B	D	D	D
Seal Beach	18070201	B	B	B	B	B	B	B
Southern Mojave	18100100	B	B	B	A	A	C	A
Ventura	18070101	B	B	B	B	B	B	D

Most of the soils underlying the proposed RTP projects fall within the B and C categories, except project 1H0101 in the Antelope-Fremont Valleys watershed (18090206), which has mostly soils classified as type A. Thus, for most of the soils of interest, the potential for runoff is moderate to significant, but not high. A related property of these soils is permeability, which measures the infiltration rate. Figure 2.10 presents a map of depth-averaged permeability for the SCAG area, and Figure 2.11 for the Santa Ana River watershed area where many of the projects are planned. Most of the projects are in areas with medium to high permeability, which indicates that for small to moderate storms, runoff will not be significant from these soils.

Another important soil feature is erodibility. The soil erodibility factor, which can range from 0 to 1, varies from 0.1 to 0.4 for most of the soils underlying the proposed RTP projects (Figure 2.12), with higher erodibility in Imperial and Ventura County soils. Figure 2.13 presents the soil erodibility at the surface for the Santa Ana River watershed, with most soils in this area ranging from 0.1 to 0.3, indicating slightly less erodibility than the overall SCAG area.

2.2 Land use

Land use and land use management have a significant influence on water quality. Understanding the land use can provide an estimate of the loading of contaminants on the land surface that eventually travel to receiving water bodies in the region. Most of the SCAG area land use has transitioned from largely undeveloped 150 years ago, to agriculture 100 years ago, to increasingly urbanized in the past 50 years. Figure 2.14 presents the level of urbanization by HSU within the SCAG area. Urbanization is concentrated in the western coastal areas, areas in which regional water quality impairments predominate. The very dry conditions of the eastern SCAG area also have influenced urbanization patterns.

Figures 2.15 to 2.22 indicate the composition of the urbanized areas, including industrial (Figure 2.15), commercial (Figure 2.16), high-density residential (Figure 2.17) and low-density residential (Figure 2.18) areas. Agriculture is prevalent in Riverside, Imperial and Ventura Counties (Figure 2.19). Rangeland and deserts cover most of the other areas (Figure 2.20), with forests being important only in a small part of San Bernardino County (Figure 2.21). Water as a land-use refers to lakes, rivers and streams, but is only significant in Imperial and Riverside Counties (Figure 2.22). Urbanization relates to highway density (Figure 2.23). This relationship shows a strong correlation between urbanization (Figure 2.14) and road density.

Water quality impairments are a function of land use, as well as management practices for different pollutants and hydrologic cycles. Watersheds with significant precipitation are more likely to result in pollutant load in runoff, and different management practices can have a significant impact on water quality.

2.3 Current Water Quality Impairments

Water quality (WQ) impairment information in the SCAG area is based on an analysis of the 2002 303(d) listing inventory. The 303(d) list is prepared by the Regional Water Quality Control Boards (RWQCBs) in California, by subwatershed. This listing is then reviewed by the State Water Resources Control Board and ultimately approved by the USEPA.

Table 2.2 TMDLs in SCAG Area

Composite categories	TMDLs
Metals	310
Pathogens	265
Solids	229
Pesticides	255
Other Toxics	231
Nutrients	195
Trash	27
Habitat/Ecosystem hazard	86
Color/odor	32
Chloride	25
pH	25
Sulfates	23
Salinity	16
Hydrology Hazard	12
Temperature	2

There are 153 types of pollutants in the list. To simplify the analysis, we have organized the pollutants as shown in Table 2.2. For the current analysis, the first seven categories (in gray) were considered relevant to the RTP projects, since the transportation network may contribute to pollutant loading.

2.4 TMDL Prioritization

In addition, the 303(d) list identifies areas where the TMDL priorities are impacting activities in the SCAG area. These priorities will vary from one class of pollutant to another, but in general there are three areas of concern: (1) coastal watersheds in Ventura, Los Angeles and Orange Counties; (2) the Santa Ana watershed which falls between Riverside, San Bernardino and Orange Counties; and (3) the Salton Sea watershed in Imperial County. Although Trash TMDLs have a high priority in Los Angeles and Ventura Counties, the RTP projects that can be affected in those areas are "point" projects, such as High Occupancy Vehicle (HOV) connectors and bridges. RTP projects that involve long extensions of the existing highway network are mostly in the Santa Ana and Salton Sea watersheds.

An important component of every plan is prioritization. Different criteria can be used to develop priorities, but in terms of water quality, it is appropriate to begin with the current impairments as indicated in the 2002 303(d) listing for southern California. To provide an overview of the spatial nature of the priorities, an overlay of the proposed RTP projects with the TMDL priorities shows seven types of impairment: Trash, Nutrients, Metals, Microbial contamination, Suspended Sediments, Toxics (other than metals or pesticides) and Pesticides. Since there are many classes of contaminants, and impairment might be a result of a combination of factors (e.g. organic enrichment might be due to excessive nutrients and conditions that lead to low Dissolved Oxygen), we have classified the impairments into these seven categories. The spatial nature of these impairments and their priorities for TMDL planning is presented for the SCAG region in Figures 2.24 to 2.30, ranging from Metals (Fig. 2.24), Pathogens (Fig. 2.25), Solids (Fig. 2.26), Pesticides (Fig. 2.27), Toxics other than pesticides (Fig. 2.28), Nutrients (Fig. 2.29), to Trash (Fig. 2.30).

2.5 SCAG Regional Transportation Projects

The proposed RTP projects consist of new highways, extensions of existing highways, additional lanes, new ramps and other improvements. These different projects will each have unique water quality impacts, depending on their type, size and location. Figure 2.31 presents an overlay of the proposed RTP and the watersheds in the SCAG area. Some of the proposed RTP Projects are long segments of highway extensions or new lanes, while others are points at this scale, since they represent only carpool (HOV = High-Occupancy Vehicle) ramps, bridges or truck access lanes. A complete listing of RTP projects, by County, is presented in Appendix G. This list includes details on project characteristics.

2.6 Potential Impacts on Water Quality from Proposed RTP Projects

This report provides a detailed characterization of the proposed RTP projects within the SCAG region, including project characteristics that are relevant for water quality assessments, the characteristics of the surrounding watershed and subwatersheds in terms of meteorology and soils, and the statistical characteristics of highways currently monitored by CalTrans.

Most of the proposed RTP projects are within existing urbanized areas, and thus may increase the loading of pollutants if the loading is not addressed by Best Management Practices (BMPs) and other control strategies. Some of the proposed RTP projects will be in areas that have not yet experienced significant urbanization and/or impairment. In these instances these projects need proper planning to mitigate and reduce associated water quality impacts as much as possible.

The proposed RTP projects can generally be categorized into three majors groups, with regards to their potential impact on water quality via stormwater runoff. Many proposed projects involve on or off ramps for a High Occupancy Vehicle (HOV) lane, or for other improvements in vehicular entry or exit from freeways. These projects tend to have a relatively small footprint within a subwatershed, relative to the footprint of the highways they serve. Other projects involve new or upgraded bridges, which may have some important flow implications during flooding, but in general should not have a major impact on water quality. These projects are likely to have a low influence on pollutant loads from the highway network.

A second group of projects involves the addition of HOV or truck climbing lanes, which generally extend for several miles, often covering more than one subwatershed. Although these extra lanes will relieve traffic, with time they are likely to result in increased throughput in the particular highway, and may thus increase the generation of pollutant load. These projects are likely to have a medium influence on pollutant loads from the highway network.

The third group involves the construction of new highways, the addition of several lanes of mixed traffic flow, extending over long distances and crossing several subwatersheds. These projects are thus likely to have a higher influence on pollutant loading, potentially resulting in the impairment of surrounding water bodies.

A preliminary estimate of pollutant loading from the RTP projects was made, based on a consideration of the new highway surface area, the average annual precipitation at the particular location, the surrounding soil characteristics, and the characteristics of highway runoff from existing facilities. Projects are categorized as having a potential for Low, Medium or High pollutant loadings, resulting directly from the transportation network and indirectly from potential changes to surrounding land-uses. Appendix H presents the proposed RTP projects ranked by category of potential adverse water quality impact (1H = high, 2M = medium, 3L = low).

Sediment load will be the major fraction in the stormwater runoff, followed by organic matter and hydrocarbons, either dissolved or as oils and greases. These pollutants may have a significant impact on the receiving waterbodies, increasing turbidity and eutrophication. Nutrient loading from the proposed RTP projects is expected to be small (on the order of kilograms per year (kg/yr) and not likely to have a significant effect on water quality. Metal and pesticide loads are on the order of grams per year (g/yr). These contaminants, however, might be toxic even at low levels, so the effect on overall toxicity will need to be evaluated in greater detail.

The Santa Ana River watershed will be the recipient of the majority of the proposed RTP projects, with significant implications in terms of the highway network and the changes in land use in the surrounding area. Development of a watershed model for this part of the SCAG region could be very advantageous. This model could analyze in more detail the potential impact of these proposed RTP projects in conjunction with other changes such as land use.

The methodology presented in this report (Appendix A) identifies the key characteristics in the proposed RTP projects, along with environmental conditions in the areas surrounding these projects. These environmental conditions (such as soil characteristics and observed meteorological conditions) can then be used to evaluate future projects and determine the potential stormwater pollutant load that might result from a project without mitigation or treatment design. This methodology can also serve as a template for other regions throughout the state where CalTrans projects are being considered.

2.7 Flood Risks from RTP Projects

This report also analyzed the RTP projects with regards to potential impacts in terms of storm runoff, in the context of their location within Federal Emergency Management Agency (FEMA) flood risk areas. Runoff was estimated based on annual precipitation (Appendix H), but this number is only representative of the total amount of water available in the rainy season. Accordingly, a better approach is to determine if a potential project is located in a high flood risk zone. An important number of RTP projects will border or cross high flood risk areas, potentially increasing storm volume during floods. Although overall contribution to flood volume is likely to be minor, project planning should consider design measures to minimize these impacts.

In addition, the transportation network typically discharges through a series of outfalls, focusing the storm flow through distinct points. This can pose an additional impact on the receiving area, particularly if it is already a high flood risk zone.

The estimate of potential stormwater runoff impacts is based on the specifics of each Plan Project (i.e., type of project, magnitude, etc.), as well as the specific characteristics of the watershed(s) and subwatershed(s) in which a Project is to be located. Our analysis integrates data from the Federal Emergency Management Agency (FEMA) with regards to flood risk areas in the SCAG counties, as well as current CalTrans outfall data for the existing transportation network, and assesses the potential impact of the RTP projects.

Figure 2.32 presents the FEMA areas of high, moderate, low and unknown flood risk in the entire SCAG region. Although the "unknown" risk zone is quite large, it corresponds mostly to very arid regions. The uncertainty is due to the fact that precipitation is typically very low, as presented in the third report), but flooding can occur locally if a large storm delivers a substantial amount of rain in a short period.

The estimated potential increase in storm runoff for each RTP project is found in Appendix I, which presents the RTP projects sorted by FEMA Flood Risk Zone and then by estimated average annual runoff, based on their dimensions and the precipitation in the area surrounding the project. Large projects generally cross several Flood Risk Zones; to be conservative the list is sorted considering any crossing of a Zone A (high flood risk) area, even though the project might only briefly border or cross that zone. The objective is to highlight those RTP projects that need to consider the exposure to storm flows in a high flood risk zone.

2.8 Planning and Coordination

At the present time water quality regulations are written so that noncompliance allows state regulators to take enforcement actions against any single local jurisdiction. As a result of these burdens and with greater awareness of shared hydrology, local governments have been prompted to explore the potentials for comprehensive control measure planning and implementation. This comprehensive approach would instead look for opportunities within a watershed where multiple jurisdictions might jointly implement solutions that bring environmental benefit, greater cost-effectiveness and fewer wasteful redundancies.

2.9 Players and Stakeholders

As part of this report, we have developed a methodology for identifying possible major partners for CalTrans as the agency develops its plans to mitigating water quality impairments that may result from the construction and operation of its proposed RTP projects. With partners, it may be feasible to include these project mitigation measures within a more comprehensive and coordinated strategy prepared by the particular subwatershed partnership. At this stage, partners are identified only at the city or county level (Appendix J). To assist in the development of priorities, this report also presents the TMDL activities planned by watershed, sorted by level of priority.

The analysis of the overlay between RTP projects and city or county jurisdictions identified potential partners for CalTrans projects in the future. Some RTP projects fall strictly within one city, but most of them involve at least two cities, or a city and the county agencies. At this stage, only the main partners were identified, although other future work can identify specific a agency or agencies and other key stakeholders within each city or county. Using this information, a long-term plan for implementing water quality projects associated with CalTrans activities throughout the SCAG area can be developed. This kind of innovative resource will help CalTrans managers use more proactive planning approaches that may result in significant cost savings for all the partners involved.

3. LOS ANGELES COUNTY

3.1 General description of the area

Los Angeles County (Figures 3.1 and 3.2), with a population of 9,979,618, has 88 cities within its boundaries (see Appendix B for a listing of cities within the county). The population in LA County is projected to grow to over 12.2 million by 2030 (SCAG, 2003), or a 22% increase. There are eight watersheds within the county: Los Angeles River, San Gabriel River, Santa Monica Bay, Dominguez Channel, Los Cerritos Channel, Santa Clara River, Antelope and Mojave (Figure 3.3). These watersheds are mainly within the jurisdiction of the Los Angeles and Lahontan Regional Water Quality Control Boards, the state agencies that regulate surface water quality through the issuance of stormwater and other discharge permits. Regional Water Quality Control Boards 5, 6 and 8 have jurisdiction over a few subwatersheds in Los Angeles County, as indicated in Appendix E. Within Los Angeles County, the two major watersheds are the Los Angeles River and the San Gabriel River. At the end of this section a case study based on the Los Angeles River watershed is presented. The San Gabriel River is discussed in the Orange County section (Section 5), since the corresponding RTP project will be in that county.

3.2 Proposed RTP Projects

Figures 3.4 and 3.5 present the location of each proposed RTP project within northern and southern Los Angeles County, and includes the cities that are in the area. In Figure 3.6, the RTP projects are presented along with the watersheds in which they would be located. Table 3.1 provides the details of the proposed RTP projects within LA County. All the projects within LA County have a small footprint, since they are either HOV connectors or a bridge in Long Beach.

Table 3.1 Proposed RTP Projects within Los Angeles County

RTP ID	Route/Program	From	To	Description	Watershed	Subwatersheds (HSU)
1M0171	Gerald Desmond Bridge replacement	-	-	Replacement of existing bridge connecting Terminal Island to I-710	18070104	405.12
1H0101	SR-14	Ave. P-8	Ave. L	Add 1 HOV lane each dir	18090206	626.5
1H0102	I-5/SR-170	North to South/South to North	-	HOV Connector	18070105	405.21
1H0103	I-5/I-405	North to South/South to North	-	HOV Connector	18070105	405.21

3.3 Current Impairments and TMDL Prioritization

Due to the high level of urbanization in LA County, the main sources of pollutant loading are urbanized areas. There are many impaired reaches of the LA River and San Gabriel River, as well as reaches of other important creeks and rivers. The cause of impairment is further analyzed in Figures 3.7 to 3.13, which presents impairment due to Metals (Fig. 3.7), Pathogens (Fig. 3.8), Sediments (Fig. 3.9), Toxics other than pesticides (Fig. 3.10), Pesticides (Fig. 3.11), Nutrients (Fig. 3.12), and Trash (Fig. 3.13). TMDL development in this area initially focused on trash and pathogens, with more recent work on the other causes of impairment. In LA County, metals, toxics and pathogens have had the highest TMDL priority, followed by trash and nutrients.

3.4 Flood risks and RTP Projects

Figure 3.14 presents an overlay of the RTP on the flood risk information for Los Angeles County. The highest risk is in the zones in northwestern Los Angeles County. A few scattered high risk zones are also seen in Los Angeles County, although in general it falls within the categories of moderate to low flood risk. Most of the RTP projects in this area have a small footprint, since they involve carpool exchanges or other access points, rather than entirely new highways. Thus, their overall impact on potential storm runoff is small. The RTP project 1M0171 in the Long Beach area is within a high flood risk zone, but it represents a replacement of an existing bridge (Gerald Desmond Bridge) and thus it is unlikely to represent a higher risk. The new bridge design should take into consideration the flood risk zoning. Project 1A0101 in northern LA County refers to the addition of a High Occupancy Vehicle (HOV = carpool) lane to SR 14. This project also borders a high flood risk zone.

3.5 Potential Stormwater Impacts from RTP Projects

Since the RTP projects in Los Angeles County have a small footprint, the potential for storm water impacts is relatively small. However, an important consideration is that storm runoff from the RTP projects might be distributed over a significant length of the expressway. For example, Figure 3.15 presents the outfalls associated with the current expressways in LA County. Although the number of outfalls is quite significant, the discharge from the transportation network is concentrated along certain points, which can lead to localized impacts. Figure 3.16 presents the outfalls associated with current park and ride lots in LA County highways, as well as maintenance facility outfalls in the county. The outfalls associated with CalTrans BMPs in LA County are presented in Figure 3.17. As the planning and design phases of the RTP proceed, it will be important to consider the overlay of high flood risk areas with the RTP projects and the various outfalls associated with these new transportation structures.

3.6 Potential for Planning and Coordination

The analysis of the overlay between RTP projects and city or county jurisdictions resulted in the identification of potential partners for CalTrans projects in the future. Some RTP projects fall strictly within one city, but most of them involve at least two cities, or a city and the county agencies. At this stage, only the main partners were identified, although a proposed future project will identify the specific agency or agencies within each city or county.

In the case of LA County, the potential partners are generally only one or two cities. The two HOV projects in LA County involve only the city of LA. The replacement of the bridge in Long Beach only involves that city. The HOV lane in SR-14 will involve the cities of Palmdale and Lancaster.

3.7 Case Study: Los Angeles River Watershed

Watershed Description

The Los Angeles (LA) River watershed has an area of 824 square miles and spans a length of 55 miles (Figure 3.18). The upper portion of the watershed (approximately 324 square miles) is covered by forest or open space land and includes the Santa Monica, Santa Susana, and San Gabriel Mountains. The remainder of the watershed is highly developed, with residential and commercial areas dominating. From the mountains, the river flows through the San Fernando Valley and eventually to the Pacific Ocean. It is bordered by rail yards, freeways, and major commercial and government buildings (CRWQCB, 1994).

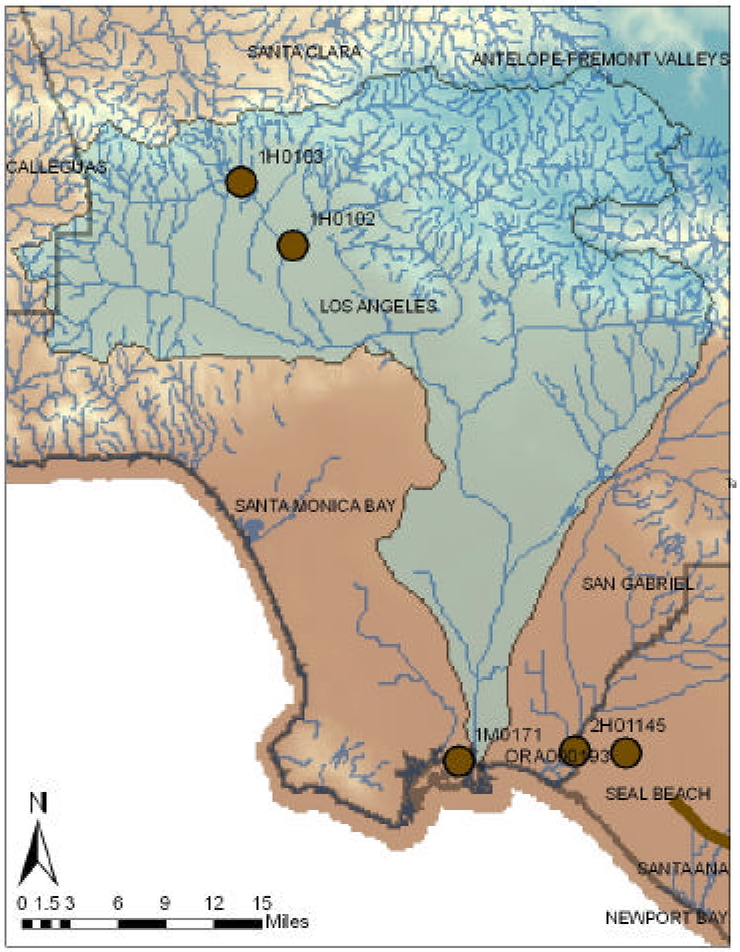

Figure 3.18 Los Angeles River watershed region, and location of the two RTP projects proposed for this area.

The majority of the LA watershed is low-lying, between zero and 240 ft elevation, with the upper reaches extending to 2000 ft in Angeles National Forest toward the northeast. Flow moves southward through the Pacoima Wash, Big Tujunga Creek, Arroyo Seco Creek, Rio Hondo, and the Los Angeles River. The watershed can be further subdivided into 13 distinct sub-watersheds, each with a unique contributing upper watershed.

Major flood events at the beginning of the century prompted the lining of river with concrete (CRWQCB, 1994). Very few areas of the Los Angeles River are not currently concrete lined, although there is a section of the river with a soft bottom at the Sepulveda Flood Control Basin in the San Fernando Valley. This section of the river was designed to collect flood waters during major storms. There is also a section of rocky, unlined bottom with concrete-lined or rip-rap sides at the eastern end of the San Fernando Valley because the water table was too high to allow for the laying of concrete. This stretch of the river supports ecological and recreational uses.

General soil characteristics of the watershed range from clay loam to silty clay, to sandy loam. The northwest corner of the region shows increased complexity with variable soil types such as coarse sand and silty clay loam.

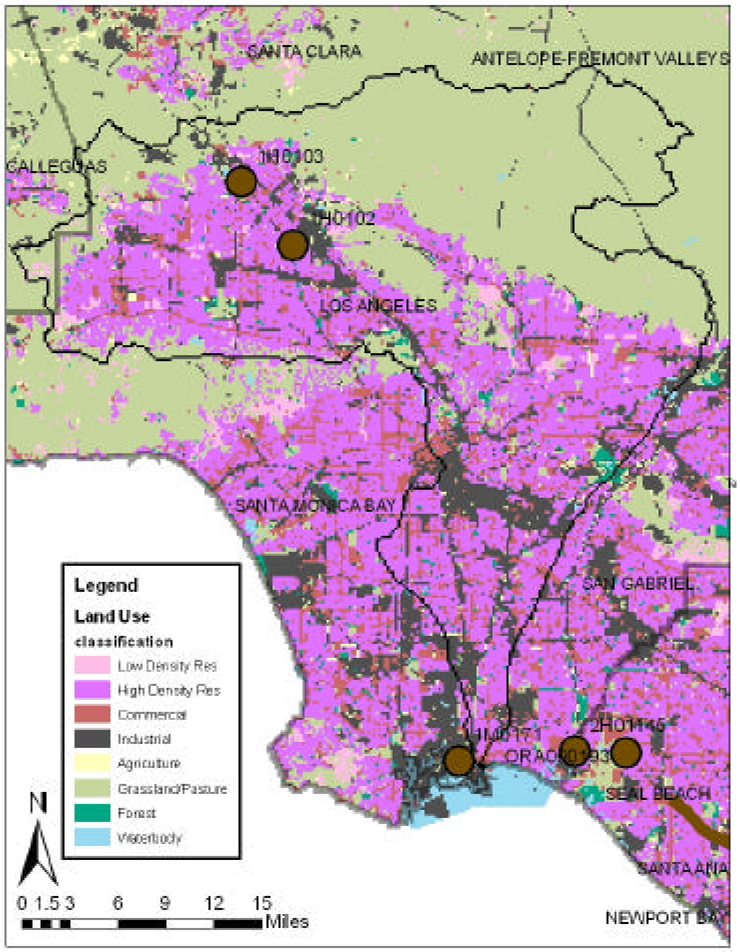

Figure 3.19. Landuse in Los Angeles River watershed (SCAG, 2003).

Population and Landuse

The majority of the region is occupied by high density residential, commercial, and industrial areas (Fig. 3.19). Los Angeles County boasts the nation's highest population with a total of over 9 million people (U.S. Census, 2000). Downtown LA is the largest urbanized center, followed by Long Beach, Burbank, Glendale, Pasadena, and Pomona. Off-core centers include Woodland Hills, Universal City, Westwood, LA Airport area, and Century City. Most medium and high density residential areas are found in downtown LA, East LA, and the "West Side" of LA, though other cities – Long Beach, Glendale, and Pasadena – also have high-density development in their downtown areas. Beach communities also display high-density housing on the ocean-front. Low-density suburbs exist eastward through southeast LA County. The location of these residential neighborhoods is controlled by the topography of the area.

Other land uses, such as commercial, industrial, and agricultural lands are found throughout the watershed. Commercial zones are largely controlled by the location of transportation corridors. Downtown LA is the historic center for office building, though there are many other office areas near the LA airport and major highway intersections (e.g. I-5 and I-405 at "El Toro Y") and near major universities such as the University of California at Los Angeles campus in Westwood. High tech companies cluster around West LA, the South Bay, Pasadena, and the Conejo Corridor off CA-101 between Ventura and LA counties. Industrial activities are focused around the Port of LA but stretch up the Alameda Corridor toward Downtown. Oil extraction activity is present in southern LA County and in Ventura. Agricultural land within the watershed is sparse.

Current State

A large portion of the Los Angeles watershed is surrounded by residential, industrial, and commercial structures and provides them with many beneficial uses. However, many of these activities have impaired the water quality in the middle and lower watershed, compounded by the high number of point source (NPDES) permits, 144 in total (Table 3.2).

Table 3.2 NPDES waste discharges into the LA watershed. From Los Angeles River Watershed (WMI Chapter, October 2004 Version)

Nature of Waste *Prior* to Treatment/Disposal	# of Permits	Types of Permits
Nonhazardous (designated) contaminated groundwater DCNWTRS	2 14	Minor General
Nonhazardous (designated) domestic sewage & industrial waste DDOMIND	4	Major
Nonhazardous (designated) wastes from dewatering, rec. lake overflow, swimming pool wastes, water ride wastewater, or groundwater seepage DMISCEL	1 6 43	Major Minor General
Nonhazardous (designated) noncontact cooling water DNONCON	2 8	Minor General
Nonhazardous (designated) process waste (produced as part of industrial/manufacturing process) DPROCES	3	Minor
Nonhazardous (designated) stormwater runoff DSTORMS	1 6	Major Minor
Hazardous contaminated groundwater HCNWTRS	2 7	Minor General
Nonhazardous (designated) domestic sewage DDOMEST	1 1	Major Minor
Nonhazardous (designated) filter backwash brine waters DFILBRI	1	Minor
Hazardous wastes from dewatering, rec. lake overflow, swimming pool wastes, water ride wastewater, or groundwater seepage HMISCEL	4	General
Nonhazardous drilling muds NDRILLS	1	General
Nonhazardous wastes from dewatering, rec. lake overflow, swimming pool wastes, water ride wastewater, or groundwater seepage NMISCEL	16	General
Nonhazardous contaminated groundwater NCNWTRS	1	General
Inert filter backwash brine waters IFILBRI	1	General
Inert wastes from dewatering, rec. lake overflow, swimming pool wastes, water ride wastewater, or groundwater seepage IMISCEL	12	General

Hazardous wastes are those influent or solid wastes that contain toxic, corrosive, ignitable, or reactive substances (prior to treatment or disposal) managed according to applicable Department of Health Services standards

Designated wastes are those influent or solid wastes that contain nonhazardous wastes (prior to treatment or disposal) that pose a significant threat to water quality because of their high concentrations

Nonhazardous wastes are those influent or solid wastes that contain putrescible and nonputrescible solid, semisolid, and liquid wastes (prior to treatment or disposal) and have little adverse impact on water quality

Inert wastes are those influent or solid wastes that do not contain soluble pollutants or organic wastes (prior to treatment or disposal) and have little adverse impact on water quality
Major discharges are POTWs with a yearly average flow of over 0.5 MGD or an industrial source with a yearly average flow of over 0.1 MGD and those with lesser flows but with acute or potential adverse environmental impacts.
Minor discharges are all other discharges that are not categorized as a Major. Minor discharges may be covered by a general permit, which are issued administratively, for those that meet the conditions specified by the particular general permit.

Due to the highly urbanized land use, high number of national permitted point source discharges, and large population size, the majority of the LA watershed is considered impaired. There are a total of 107 individual impairments (CalEPA 2004), including pH, ammonia, coliform, trash, scum, algae, oil, chlorpyrifos, as well as other pesticides, and volatile organics. Ground water resources are also impaired from hundreds of cases of known leaks from underground storage tanks, chloride from seawater intrusion, and nitrate from septic systems.

The key concerns with the impairments are the impacts to fish and wildlife habitat, recreational areas, balancing environmental water flow needs with other uses, storm water quality, non-point pollution sources from agriculture, golf courses, and septic systems, pollution from contaminated sites, ground water quality, heavy metal contamination, and contaminated sediments within the LA River estuary (CalEPA 2004).

Projected Changes

The 2004 SCAG Regional Transportation Plan Program Environmental Impact Report (EIR) shows a number of changes for the population and land use within the Los Angeles watershed. According to the EIR, between 1990 and 2000 Los Angeles County grew by 650,000 people and another 470,000 from 2000 to 2003 (Table 3.3). The majority of this growth is attributed mostly to aging Baby Boomers and their children, but also to Mexican, Central American, and Southeast Asian immigrants.

Table 3.3 Population trends for Los Angeles County.

County	1990 Total Population	2000 Total Population	2003 Population Estimate	1990-2003 Population Increase	1990-2003 Percent Increase
Los Angeles	8,862,164	9,519,338	9,979,618	1,116,454	13

Potential RTP Impacts in LA River watershed

Since there are only two RTP projects with small footprints planned for this watershed, the incremental impact is expected to be small.

4. VENTURA COUNTY

4.1 General description of the area

Ventura County (Figure 4.1), with a current population of 791,310, has 10 cities within its boundaries (see Appendix F for a listing of cities within the county). Ventura County is a fast growing region in California. The population in 1990 was 669,016, and by 2000 the population grew to 758,100 residents. The Southern California Association of Governments (SCAG) projections for the county show a continued population increase; they estimate over 990,000 residents in 2030 (SCAG, 2004), or a 30% increase. The County is comprised mainly of three watersheds: Santa Clara River, Calleguas Creek and Ventura River (Figure 4.2). Other small coastal watersheds are incidental management areas. All of these watersheds are within the jurisdiction of the Los Angeles Regional Water Quality Control Board, the state agency that regulates surface water quality through the issuance of stormwater and other discharge permits. However, some subwatersheds within Ventura County fall within the jurisdiction of the Central Coast RWQCB (i.e. 312.3, 314.51, 315.34), and one is overseen (556.3) by the Central Valley RWQCB. Since the two RTP projects fall within the Calleguas Creek Watershed, a case study of this watershed is presented at the end of this section.

4.2 Proposed RTP Projects

For Ventura County, the two proposed RTP projects are within already impaired subwatersheds of Calleguas Creek (Table 4.1), and the projects may increase the impact on these HSUs. Since the two projects involve significant extensions of existing highways, the impact may be high. Figure 4.3 presents the location of each proposed RTP project within Ventura County, and Figure 4.4 presents an overlay of the RTP projects and the watersheds in this county.

Table 4.1 Proposed RTP Projects within Ventura County

RTP ID	Route/Program	From	To	Description	Watershed	Subwatersheds (HSU)
5A0103	SR-118	SR-232	Moorpark	Expressway	18070102, 18070103	403.11, 403.12, 403.61, 403.62
5A0101	SR-33 (Casitas Bypass)	Foster Park	Creek Rd	Expressway	18070101	402.1, 402.2

4.3 Current Impairments and TMDL Prioritization

The cause of impairment is presented in Figures 4.5 to 4.11, which depict the impairment due to Metals (Fig. 4.5), Pathogens (Fig. 4.6), Sediments (Fig. 4.7), Toxics other than pesticides (Fig. 4.8), Pesticides (Fig. 4.9), Nutrients (Fig. 4.10), and Trash (Fig. 4.11). Most of the impairments in Ventura County are in the Calleguas Creek watershed, described in more detail in the case study at the end of this section, as well as in the lower Santa Clara River which is affected by nutrients and pesticides.

Impairment due to Trash is generally a significant problem in Ventura County. However, the proposed extension to Hwy 118 falls mostly within an area not currently listed as impaired due to trash. Nutrients have an impact over a wider area. In the case of impairment due to metals, the highest priority is in the Calleguas Creek watershed. Microbial contamination due to pathogens is widespread throughout the SCAG region, and ranks high in priority, in particular in Ventura

County. Toxics and pesticides are ranked as high priority in Ventura County as well.

4.4 Flood risks and RTP Projects

Figure 4.12 presents the flood risk information for Los Angeles and Ventura Counties. The highest risk is in the unlined channels of the Santa Clara River, Ventura River, and Calleguas Creek. RTP Project 5A0103 in Ventura County corresponds to an extension of SR 118 from Moorpark to SR 232. This project is planned along the Arroyo Las Posas, which is designated as a narrow high flood risk zone. Mitigation measures should be considered in the design of this extension. The Casitas Bypass project along SR 33 (Project 5A0101) is planned along the Ventura River, another high flood risk area, with some moderate increase in potential stormwater runoff. There can be a significant storm runoff contribution from this project, as indicated in Appendix I, which shows the estimated potential increase in storm runoff for each RTP projects.

4.5 Potential Storm Water Impacts from RTP Projects

The two RTP projects in Ventura County involve significant extensions of the existing road network. In particular, Project 5A0103 is 26.6 km long, which can have some significant implications for water quality in the area. This project runs along the Arroyo Las Posas floodplain, so the potential for direct impacts to the waterbody should be minimized through preventive measures such as riparian vegetation buffers and treatment of outfalls. The Casitas Bypass project is 5 km long, so it can also have impacts on the receiving waterbody in that region.

4.6 Potential for Planning and Coordination

The analysis of the overlay between RTP projects and city or county jurisdictions resulted in the identification of potential partners for CalTrans projects in the future. In the case of Ventura County, the potential partners are generally only one or two cities. However, the Calleguas Creek Watershed Management group has developed an effective working group of stakeholders who have been working with the Regional Board to comprehensively plan pollution control measures that will eliminate the current water impairments. This effort may be the most successful model of water quality collaboration currently within the SCAG region. These initiatives offer CalTrans an optimal kind of setting for coordinated planning.

4.7 Case Study: Calleguas Creek Watershed

Watershed description

The Calleguas Creek Watershed lies within southern Ventura County and has an area of approximately 343 square miles. Five sub-basins comprise the watershed; they are Conejo Creek, Arroyo Santa Rosa, Arroyo Simi, Arroyo Las Posas, and Calleguas Creek. Near the watershed terminus lays Revolon Slough and Mugu Lagoon. The watershed generally flows in a west direction towards Mugu Lagoon (Figure 4.13).

The average rainfall for the County is fifteen inches per year, although there is a slight variation between the coastal and inland areas. The Watershed experiences approximately 15-20 discrete storm events each year that produce large amounts of rain in a short period of time; more than 85% of the rain occurs between the months of November and March. Temperatures in the region are fairly mild with averages ranging from 53 to 64 degrees Fahrenheit. Elevations in the Watershed vary from sea level at the coast to 3,767 feet in the eastern foothills.

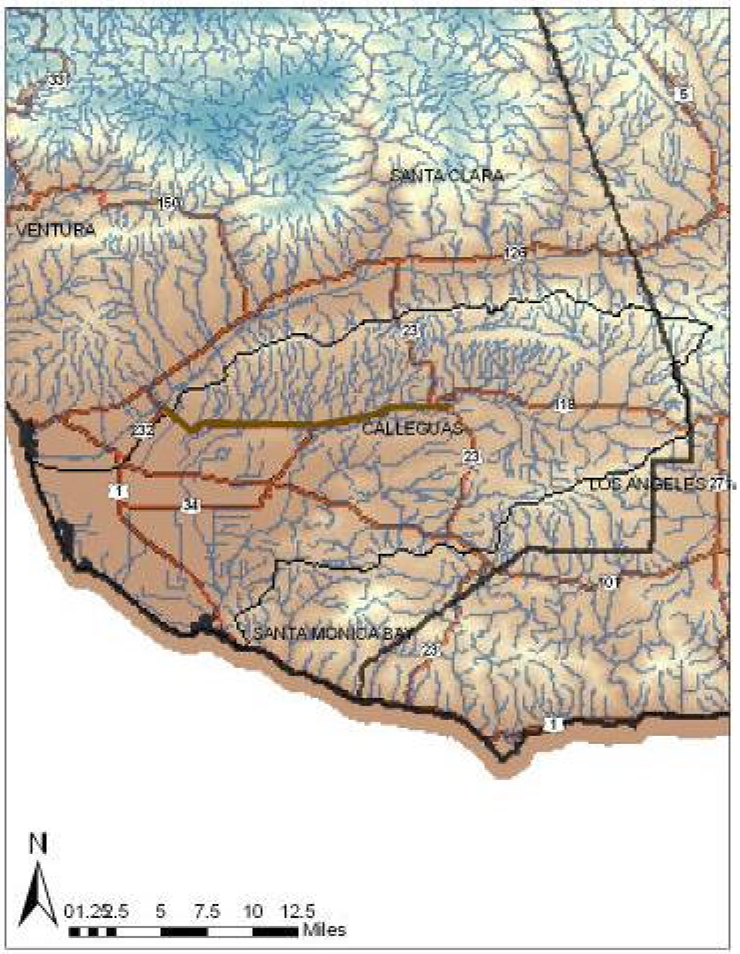

Figure 4.13 Calleguas watershed and proposed RTP project

Landuse

The land cover of the watershed is approximately 50 percent undeveloped, 25 percent agricultural, and 25 percent urban. Dominant land-cover in the undeveloped areas consists of scrub and chaparral. The agricultural activities in the surrounding areas make up the majority of the area's economy and consist of orchard and row crops. These activities occur primarily in the central and western part of the watershed. In 1999, Ventura County was the tenth highest agricultural producing county in California (Calleguas Creek Watershed Mangement Plan, 1996). Also, several other sectors provide employment and will continue to expand, such as Biotechnology, Telecommunications & Advanced Technologies, Manufacturing, Tourism, Military Testing and Development (County of Ventura, California 2004).

Land use is changing rapidly in the Calleguas watershed largely due to the growth of Thousands Oaks, Simi Valley, Moorpark and Camarillo. Current land use in the watershed is spatially represented in Figure 4.14. The predominant land use change is from agricultural/grazing/open lands to urban and residential. In the Calleguas Creek Watershed, population projections show an increase in population from 320,000 residents in 2000 to 400,000 in 2020 (Calleguas Creek WMP, 2004). This would lead to a 6% increase in residential acreage. Urban areas are expanding at a high rate to accommodate this influx of people. Currently, residential land use accounts for approximately 13.3% of the Watershed and it is expected to increase to 17.9% by 2020. The increase in residential land use will be at the expense of agricultural and open space land uses. The main urban areas in the Watershed are the cities of Simi Valley, Moorpark, Camarillo, and Thousand Oaks.

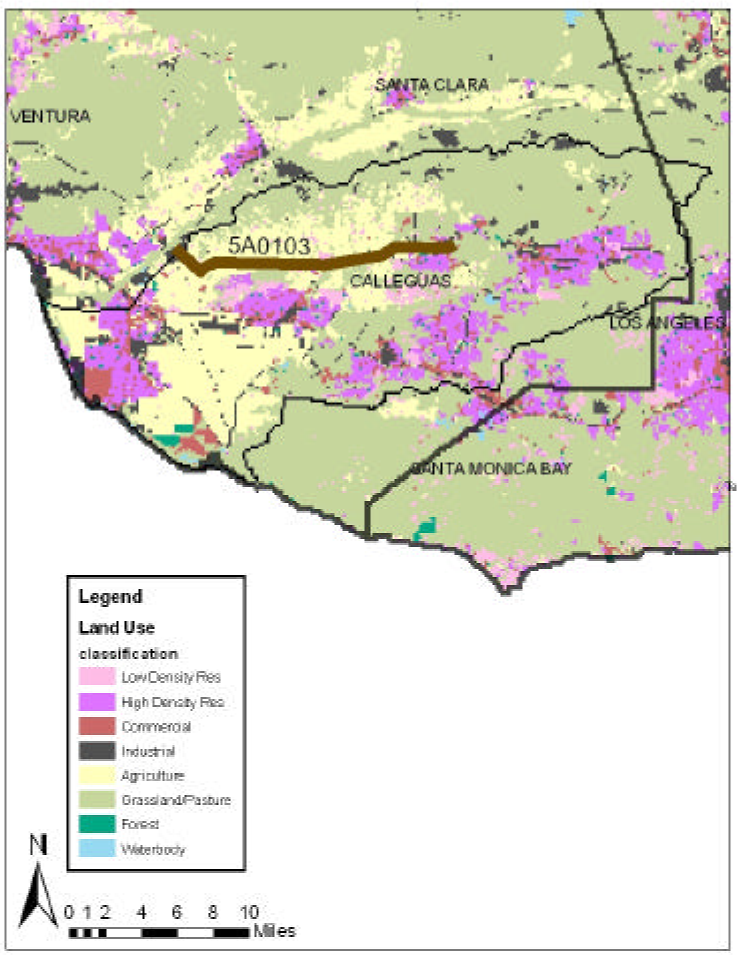

Figure 1.13 Landuse for the Calleguas watershed

Watershed Issues and Challenges

The Calleguas Creek Watershed faces many environmental issues as outlined below (Calleguas Creek WMP, 2004):

- Water scarcity and conflicting water uses
- Proper regulation of point and non point discharges
- Control of toxic releases
- Erosion/sediment loss due to agriculture and urbanization
- Potential conflicts between wetland conservation and planned urban uses
- Lack of data regarding species and habitat impacts
- Potential loss of upland habitat that could lead to endangered species
- No coordinated strategy regarding land conservation
- Piecemeal environmental regulation and response
- Maintaining and enhancing the quality of life

The Calleguas Creek Watershed of Ventura County, California is one of the most impaired watersheds in the state of California (California EPA and Los Angeles RWQCB, 2004). The California Environmental Protection Agency, Los Angeles Regional Water Quality Control Board's 2004, "Watershed Management Initiative" describes the Calleguas Creek Watershed (CCW), and in particular Mugu Lagoon and the Calleguas Creek Estuary as a "toxic hot spot" due to several factors: reproductive impairment, exceedance of advisory levels for mercury and DDT in fish, sediment concentrations of DDT, PCB, chlordane, chlorpyrifos, sediment toxicity and degraded benthic community. To accommodate issues of ecosystem sensitivity and resource availability in the face of large urban/suburban growth the Calleguas Municipal Water District (CWMD), with approval by the state, is working on the implementation of a comprehensive, multi-pollutant TMDL.

In response to these issues, stakeholders developed the Calleguas Creek Watershed Management Plan (WMP) in 1996. The purpose of this effort is to manage resources and develop protection strategies for the area. The WMP outlines recommendations and action items for the Watershed under six main issue areas: water resources and water quality, habitat and recreation, flood protection and sediment management, agriculture, land use, and public outreach and education (Calleguas WMP, 2004).

Current Impairments

Impairment of waterbodies in Calleguas Creek affects drinking water supply, aquatic life support, or recreation. 17 reaches of Calleguas Creek or tributaries have been listed for a wide range of pollutants including ammonia, ChemA, chlordane, copper, DDT, endosulfan, fecal coliform, nitrogen, PCBs, sediment toxicity, sedimentation/siltation, toxaphene, excessive algae, boron, chlorpyrifos, fecal coliform, dieldrin, selenium, sulfate, total dissolved solids and trash. Increased sedimentation in the Calleguas watershed has resulted from both land use changes and poor agricultural practices. Though other sources of the sedimentation problem exist, these two causes are considered the major contributors. Anthropogenic land use conversion and the physical characteristics of the Calleguas Watershed have led to increased sedimentation in Calleguas creek and Mugu Lagoon. As impervious surfaces increase, the volume of flow routed through the hydrologic network of creeks and drainages will adjust the geomorphology accordingly. Though erosion is a natural process, in the case of urban growth, erosion generally contributes to decreased water quality downstream and can drastically reduce property values in the eroding areas. Efforts to contain and manage erosion (through channelization and flood routing) commonly export the problems further downstream.

Much of the watershed is characterized by agricultural or grazing land uses which can contribute large loads of sediment into the system. Furthermore, due to a long history of agriculture, much of the watershed is contaminated with agricultural pesticides and other chemicals. When this contaminated sediment is mobilized many of these chemicals are released into the watershed. Of particular concern is the concentration of DDT in sediments. DDT is a primary contributor to poor waterfowl survival rate in the Mugu lagoon. By controlling erosion one can reduce the loads of other criteria pollutants that are tied to the sediment.

Effects on the Ecosystem

Stemming from the engineered importation and diversion of external water sources in combination with agricultural groundwater wells, surrounding ecosystems have undergone a dramatic change. What were historically seasonal creeks now flow year-round due to urban runoff, discharge from wastewater treatment plants and irrigation runoff.

Throughout the watershed, urban expansion of the municipalities, Simi Valley, Moorpark, Thousand Oaks, and Camarillo have had a number of effects. These urban areas have seen extensive growth; in 2000, Ventura County had a population of 753,197, an increase of 84,181 people from 1990 (Wilson, 2001). Not only have the cities increased in size, changing the nearby hydrologic cycle, but they have displaced agricultural practices outward into higher elevations and onto lands that have steeper slopes. This agricultural shift in land has been focused almost exclusively into the hillsides; from the years of 1968 to 1988 the number of acres utilized for agriculture increased by 13,120. Of these, 11,808 acres were in the hillsides (Ventura County Resource Conservation District, 2000).

The expansion of agriculture into the hillsides has converted previously undeveloped land to irrigated row crops and orchards, causing an increase in erosion and sedimentation rates (Ventura County Resource Conservation District, 2000). This expansion and the ensuing erosion problems are considered the primary sources of sediment load into the watershed and was identified as a problem as early as 1950, when "…about one-third of the Calleguas Creek Watershed was documented as severely or very severely eroded" (Ventura County Resource Conservation District, 2000).

Urban areas also contribute to the sedimentation and erosion problem as engineering practices construct channels to direct flow away from developed areas. This leads to an increase in flow rates and volume which directly enhances the scouring potential of the waterways and an increase in the capacity to carry more bed and suspended load (Ventura County Resource Conservation District, 2000).

Potential RTP Impacts in Calleguas Creek Watershed

Although there is only one RTP project planned for Calleguas Creek, it will be a major extension of Hwy. 118, and is planned along the flood plain of the creek. The potential for water quality impacts is significant, and measures are needed in order to prevent adverse impacts.

5. RIVERSIDE COUNTY

5.1 General description of the area

Riverside County (Figures 5.1 and 5.2), with a population of 1,705,537, has 24 cities within its boundaries (see Appendix F for a listing of cities within the county). Population is expected to grow to around 3.15 million by 2030 (SCAG, 2004), or a remarkable 85% growth, accommodating a significant fraction of the increase in the SCAG area. The County is comprised of 8 watersheds: Aliso-San Onofre, Imperial Reservoir, Salton Sea, San Jacinto, San Luis Rey-Escondido, Santa Ana, Santa Margarita, and Southern Mojave (Figure 5.3). These watersheds are within the jurisdiction of the Santa Ana, Lahontan and the Colorado River Basin Regional Water Quality Control Boards, the state agencies that regulate surface water quality through the issuance of stormwater and other discharge permits.

The Santa Ana Watershed falls partially within three counties: Riverside, Orange and San Bernardino. More than half of the proposed RTP projects are located in this rapidly urbanizing watershed. In this section of the report we have included a case study of this watershed, along with one of the Santa Margarita Watershed.

5.2 Proposed RTP Projects

Many of the proposed projects (Table 5.1) will be within Riverside County. The proposed RTP projects in Riverside are mostly in unimpaired watersheds, or at least in watersheds with low to medium TMDL priority. Figures 5.4 and 5.5 presents the location of each proposed RTP project within Riverside County. Since many of these projects involve significant extensions of existing highways, the potential for impact is considerable. A significant number of proposed RTP projects are concentrated within a small section of the Santa Ana River Watershed, between Riverside and San Bernardino Counties (Figures 5.6 and 5.7).

5.3 Current Impairments and TMDL Prioritization

Impairment in Riverside County is primarily attributed to pathogens, sediments, toxics and nutrients. Figures 5.8 to 5.11 present the spatial distribution of impairment in Riverside County due to Pathogens (Fig. 5.8), Sediments (Fig. 5.9), Toxics other than pesticides (Fig. 5.10), and Nutrients (Fig. 5.11). Most of the priorities are medium to low, except for the subwatershed (HSU) 802.31 which falls within the Santa Ana River Watershed.

5.4 Flood risks and RTP Projects

Figure 5.12 presents the flood risk information for Riverside County. In addition to the Santa Ana River, there is high flood risk in the San Jacinto River and its tributaries, as well as in the White River and Mission Creek areas. This area will have the largest number of the proposed RTP projects, and is also the focus of rapid urbanization. Thus, the relatively large high flood risk area may be impacted by the proposed RTP projects. Project 2M04121 and 3M04MA10 add a multiflow lane in each direction to SR 91, which borders the upper Santa Ana River. Project 3M01MA06 adds a High Occupancy Vehicle (HOV) lane to I-15, which crosses the Santa Ana River and some of its tributaries.

Table 5.1 Proposed RTP Projects within Riverside County

RTP ID	Route/Program	From	To	Description	Watershed	Subwatersheds (HSU)
3C01MA01	CETAP - Cajalco/Ramona	Hemet	Corona/Lake Elsinore	Cajalco/Ramona expressway (3 lanes each dir) from Sanderson Ave to I-15	18070203	801.32, 801.33, 802.11, 802.14, 802.15, 802.21
3M04MA10	SR-91	Pierce Street	Orange County Line	Add 1 MF lane each direction	18070203	801.13, 801.25, 801.26
3A01MA01	SR-79	Ramona Expwy	Domenigoni Parkway	Realign highway (construct 4 lanes)	N/A	N/A
3M01MA08	I-215	SR-60/SR-91/I-215 Jct	San Bernardino County Line	Add 1 MF and 1 HOV lane each direction (EA 467200)	18070203	801.27
3TK04MA12	I-10	San Bernardino County Line (R0.0)	Banning City Limits (12.9)	Add eastbound truck climbing lane	18070202, 18070203	801.62, 801.63, 801.67, 802.21
3H01SH03	SR-60/I-215	SR60/I-215 E. Jct	East to SR-60 and South to I-215	HOV Connector	18070203	801.27
3M01MA06	I-15	San Diego County Line (R0.0)	SR-60 (51.5)	Add 1 HOV lane each direction (EA's 33790G, 33800G)	18070202, 18070203, 18070302	801.21, 801.25, 801.32, 801.34, 801.35, 802.31, 902.31, 902.31, 902.32, 902.33, 902.42, 902.52
3M04MA11	SR-91/I-15	South to West/West to South	-	HOV Connector	18070203	801.25
3M01SH06	I-10	Monterey Ave (44.5)	Dillon Rd (58.9)	Add 1 MF lane each direction (EA 0A030K)	18100200	719.47
3M01MA07	I-215	Eucalyptus Ave (R37.4)	I-15 (R8.9)	Add 1 MF lane each direction (EA's 35380K, 35390K, 35370K)	18070202, 18070203, 18070302	801.27, 802.11, 802.12, 902.32, 902.33
3A04SH12	SR-79	Hunter	Ramona Expwy	Widen from 4 to 6 lanes (note: RTIP#46460 widens to 6 lanes from Hunter to Domenigoni)	18070202	802.13, 802.15, 802.21, 902.33, 902.35
3M04MA05	I-10/SR-60	-	-	Construct new interchange	18070203	801.62
3M01MA09	SR-71	SR-91	San Bernardino County Line	Widen to 3 MF lanes each direction	18070203	801.13, 801.21, 801.25
3TK04MA13	SR-60	Badlands area east of Moreno Valley	Badlands area - west of SR-60/I-10 Jct	Add eastbound truck climbing lane	18070202, 18070203	801.62, 802.21

5.5 Potential Stormwater Impacts from RTP Projects

The large number of projects planned for this area will increase the potential for impacting receiving water bodies which are already impaired or threatened due to current land uses. Some of the projects involve significant extensions. Over 300 km (190 miles) of additional lanes or highway extensions are planned for this area, plus a number of smaller projects. Although the potential increase in storm runoff from each of these projects is moderate, the combined effect of several projects can result in increased flooding risks in this area.

The case study for the Santa Ana River Watershed, presented in Section 5.7, highlights the potential impacts of the existing and proposed transportation network. This region already has impairments due to a number of classes of pollutants. Planning must be done in advance of the projects to minimize the potential impact of the RTP projects. The Santa Margarita River Watershed (Section 5.8) is also likely to be significantly affected by the major extensions of highways into this relatively undeveloped area.

In addition to the Santa Ana and Santa Margarita Watersheds, there could be some potential impacts in the San Jacinto River and its tributaries, as well as in the White River and Mission Creek areas, all of which are high flood risk zones. There can be a significant storm runoff contribution from these projects, as is indicated in Appendix H that shows the potential increase in storm runoff for each RTP project.

5.6 Potential for Planning and Coordination

The proposed RTP projects in Riverside and San Bernardino Counties are generally focused on the western portion of these two counties. Most of these projects involve significant extensions of existing highways, as well as a combination of new HOV lanes or connectors, and additional truck lanes. There are many cities in Riverside County which can play a role in the development of joint projects, such as the cities of Riverside, Corona, Norco, Perris, Murrieta, Beaumont, San Jacinto and Temecula. Towards the east, the proposed increase in a multi-flow lane in I-10 will involve the cities of Palm Desert, Indio and Coachella. Within San Bernardino County, the cities most likely to be involved include San Bernardino, Rialto, Fontana, Colton, Yucaipa, Rancho Cucamonga, Ontario, Hesperia, Victorville and Adelanto. In addition, many of the projects cross unincorporated areas and involve county agencies.

In the Santa Ana Watershed, the Santa Ana Watershed Project Authority (SAWPA) is an agency with a regional vision for water quality and is positioned to be an effective ally in comprehensive planning efforts throughout the watershed. SAWPA (http://www.sawpa.org/) is comprised of five water districts: Eastern Municipal Water District, the Inland Empire Utilities Agency, Orange County Water District, San Bernardino Valley Municipal Water District and the Western Municipal Water District.

5.7 Case Study: Santa Ana River Watershed

Watershed Description

The Santa Ana River watershed is the largest coastal river system in Southern California, spanning four counties: Orange, southwestern San Bernardino, northwestern Riverside, and the eastern edge of Los Angeles (Figure 5.13). The Santa Ana River is over 100 miles long with more than 50 tributaries. The watershed covers an area of approximately 2,800 square miles (Santa Ana Watershed Project Authority, 2002).

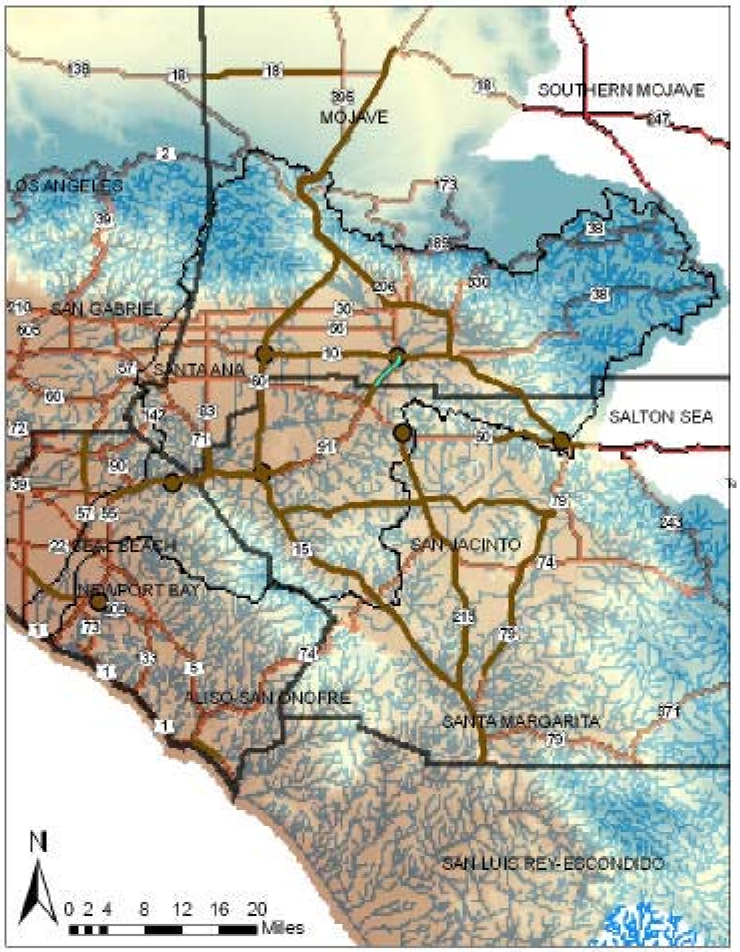

Figure 5.13 Santa Ana River Watershed

The watershed crosses the Peninsular and Transverse Ranges. Its highest elevations occur in San Bernardino County (San Gorgonio Peak, 11,485 ft), the eastern San Gabriel Mountains (Mt. Baldy, 10,080 ft) and in the San Jacinto Mountains (Mt. San Jacinto, 10,804 ft). The major slope direction runs from northeast to southwest (Santa Ana Watershed Project Authority, 2002). As the river flows out of the mountains, it crosses the Santa Ana Valley, to a pass in the Santa Ana mountains where Prado Dam is located (California State Coastal Conservancy, 2001). Finally, the river flows southwest across the coastal plain through Orange County to the Pacific Ocean.

The San Andreas fault zone is a major geologic feature in the Santa Ana Watershed and runs southeast to northwest at the base of the San Bernardino Mountains, causing the San Bernardino and San Gabriel mountain ranges to uplift. The Santa Ana Watershed contains three other major faults: the San Jacinto Fault, the Elsinore-Whittier Fault, and the Newport-Inglewood Fault. In addition to these major faults, there are many smaller faults that branch off, contributing to the area's complex geology (California State Coastal Conservancy, 2001). The mountainous parts of the watershed are comprised of uplifted batholith, granitic and andesitic rocks (Santa Ana Watershed Project Authority, 2002). The areas of lower elevation are dominated by alluvial and fluvial sediment – mostly fine sand and silt – which is highly permeable and erosive. Near the river mouth, soils are higher in organic content from mostly vanished wetlands (California State Coastal Conservancy, 2001).

Surface Water

Table 5.2 summarizes the surface water path and major characteristics of the Santa Ana River.

Table 5.2 Stages and characteristics of the Santa Ana River

Location	Characteristics
San Bernardino Mountains	River begins in the uplands High gradient and impervious soil type leads to little surface water percolation Snowmelt and storm runoff comprise most of the flow Water quality is generally good
Upper Valley: Seven Oaks dam to the City of San Bernardino	Flow consists mainly of storm flows, flows from San Timoteo Creek and groundwater rising due to local geologic features
City of San Bernardino to the City of Riverside	River flows perennially, mainly due to treated discharge from wastewater treatment plants
City of Riverside to the recharge basins below Imperial Highway	Flow consists of highly-treated wastewater discharges, urban runoff, irrigation runoff and groundwater forced up by geologic features
Santa Ana Mountains to the Orange County coastal plain	Gradient decreases and channel lessens as river flows onto the coastal plain Much of the river is contained in concrete-lined channels
Huntington Beach	River discharges into the Pacific Ocean

Surface water is held at numerous locations throughout the Santa Ana watershed. Lake Elsinore is the only naturally occurring freshwater lake of significant size. Water storage reservoirs include Lake Perris, Lake Mathews and Big Bear Lake. Prado Dam and Seven Oaks Dam are important flood control areas and also provide water storage capacity for water conservation and management (California State Coastal Conservancy, 2001).

Due to the watershed's dry climate, dams, diversions for irrigation and water supply, and groundwater pumping, the Santa Ana River does not have a large baseflow for the majority of the watershed. Many segments dry up in the summer or flow only after precipitation events. However, baseflow in other parts of the Santa Ana River is increasing due to increased flows from upstream wastewater treatment facilities, particularly in the lower parts of the watershed (Orange County Water District, 2004). In addition, urbanization and the increase of impervious surfaces are also contributing to an increase in stormflow runoff.

Groundwater

The Santa Ana Watershed has approximately 40 groundwater basins in the 1,200 square miles of aquifer in the upper watershed (above Prado Dam) and about 400 square miles in the lower watershed (California State Coastal Conservancy, 2001). Groundwater generally flows northeast to southwest, in the same direction as surface water (Santa Ana Watershed Project Authority, 2002).

Land Use

The Santa Ana Watershed has one of the fastest-growing populations in California. Over the last 20 years, agricultural land has been converted to residential, commercial, and industrial use at an unprecedented rate. According to the 2000 U.S. Census, the population of the Santa Ana watershed is approximately 4.8 million. Studies project the population of the watershed will grow to 7 million by 2025 and 10 million by 2050 (Santa Ana Watershed Project Authority, 2002). This growth will continue the trend of land use conversion from agriculture and open space to residential, commercial, and industrial development.

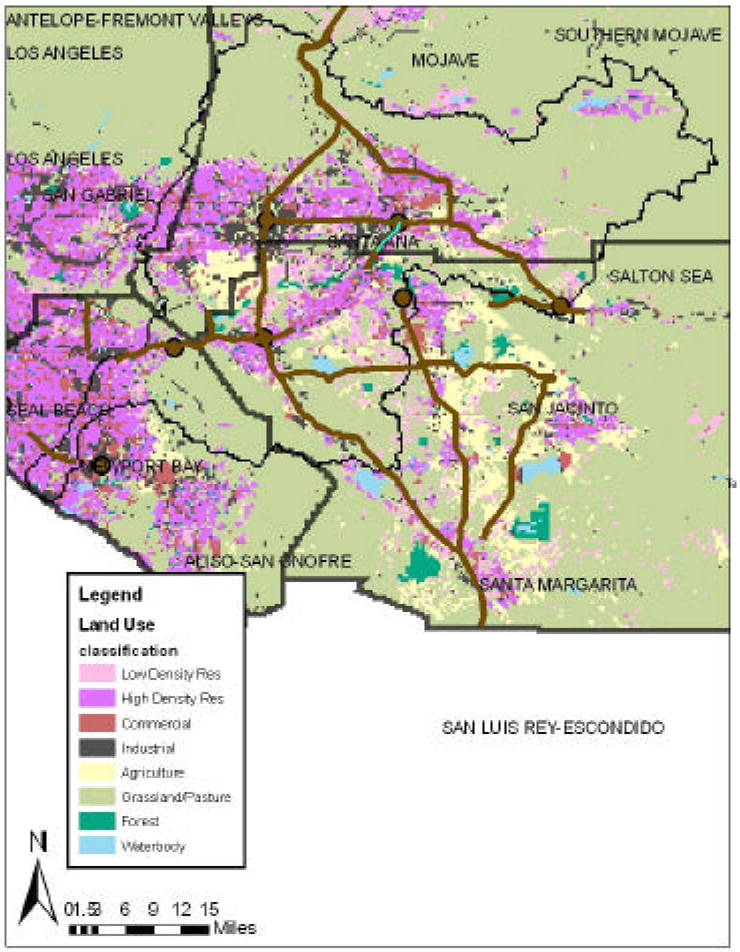

Figure 5.14 Land use in the Santa Ana River watershed

Habitat

The Santa Ana Watershed has a very high level of species diversity, along with the largest number of dams and road crossings within the SCAG region (Southern California Association of Governments, 2003). Endangered and threatened species can be found along the length of the watershed, from the San Bernardino kangaroo rat in the upper watershed, to the least Bell's vireo, Belding's savannah sparrow, and the California least tern along the river mouth (California State Coastal Conservancy, 2001). The majority of intact riparian habitat is in the upper part of the watershed, while the lower part of the watershed has been severely modified for flood control purposes. In addition, several invasive species are responsible for habitat degradation, including the brown-headed cowbird, which is a brood parasite of the least Bell's vireo, and arundo donax, an invasive type of aggressive bamboo that overtakes native vegetation and consumes large quantities of riparian water supplies.

Surface Water Impairments and Risks

Surface water quality is good in the upper parts of the watershed, and deteriorates as the river flows towards the coast. According to SCAG, the primary water quality problems in the Santa Ana River are salinity and chlorides, nutrients, pathogens, and total dissolved solids (Southern California Association of Governments, 2003). One area of concern is the lower part of the upper basin between Riverside and the Santa Ana Canyon, which is high in bacteria (California State Coastal Conservancy, 2001). The entire lower watershed is impaired with nitrates from upstream wastewater flow. Interactions between pollutants and salts can create large fluctuations in pH, which is detrimental to wildlife and can corrode infrastructure (California State Coastal Conservancy, 2001). The worst water quality can be found in the southern part of the Chino Basin where the water is high in total dissolved solids and nitrates from intensive agricultural uses such as confined feeding operations. Other contaminants threatening groundwater quality in the Chino Basin include perchlorate, mercury, TCE, PCE, and Chromium IV (Inland Empire Utilities Agency, 2000).

Potential RTP Impacts in the Santa Ana Watershed

The Santa Ana Watershed already contains a significant number of highways and road networks. The Santa Ana Watershed landscape will be the location for the majority of the proposed RTP projects. This has significant implications in terms of the growing highway network and changes in land use in surrounding areas. These factors argue for the development of a watershed model for this particular region that can evaluate in greater detail the potential impact of these proposed RTP projects and related land use changes, and guide mitigation planning.

5.8 Case Study: Santa Margarita Watershed

Watershed Description

The Santa Margarita Watershed encompasses 750 square miles in northern San Diego and southwestern Riverside counties. Approximately 27 percent of the watershed is within San Diego County. The watershed includes all or part of the incorporated cities of Temecula, Hemet, Murrieta, and Oceanside, the Fallbrook Naval Weapons Station, a portion of U.S. Marine Corps Base (USMCB) Camp Pendleton, a portion of the unincorporated County of Riverside, and the County of San Diego. The Santa Margarita River is formed near the city of Temecula at the confluence of the Temecula and Murrieta Creek systems. The Santa Margarita River main stem flows through the unincorporated areas of San Diego County, the community of Fallbrook and the USMCB Camp Pendleton before finally discharging into the Pacific Ocean through the Santa Margarita River Estuary. The watershed contains a variety of nearly intact habitats including chaparral-covered hillsides, riparian woodlands and coastal marshes. Currently, the Rainbow Creek tributary and the Santa Margarita Lagoon are listed on the Clean Water Act's 2002 303 (d) listing due to excessive inputs of nutrients (County of San Diego Land Use and Environmental Group, 2003).

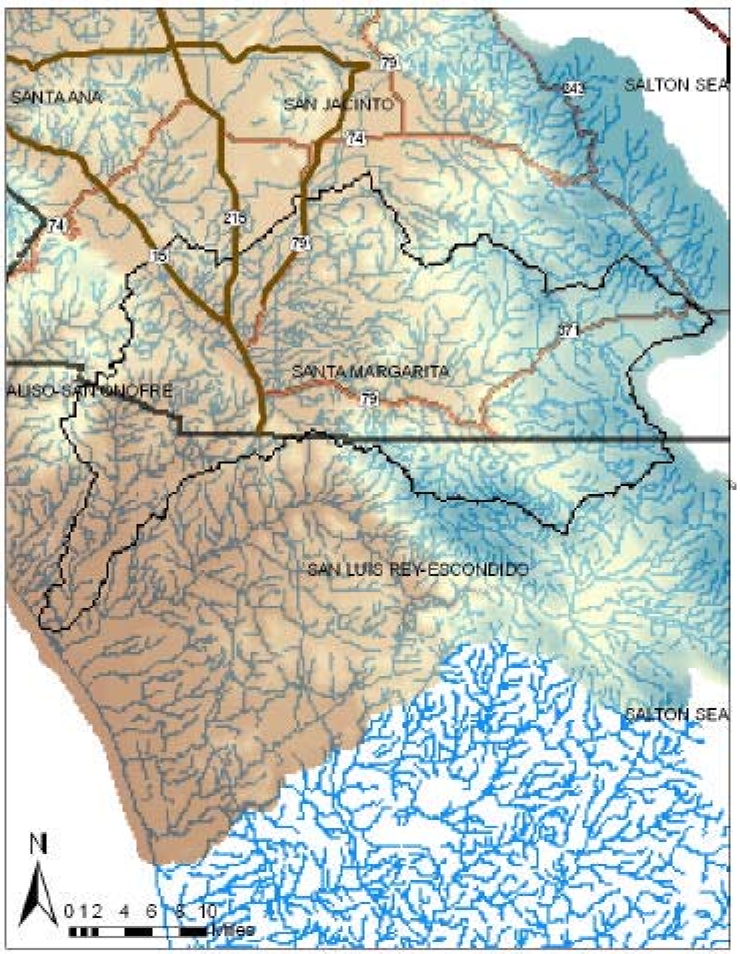

Figure 5.15 Santa Margarita Watershed

Surface Water

The upper Santa Margarita Watershed contains a network of largely ephemeral streams dominated by Santa Gertrudis, Temecula and Murrieta Creeks. The Santa Margarita River is 27 miles long from its headwaters to its discharge point at the Pacific Ocean (U.S. Department of the Interior Bureau of Reclamation (USDI) & Stetson Engineering Inc. (Stetson), 2005). The Santa Margarita Watershed consists of nine hydrologic basins and 33 sub-basins delineated primarily on surface drainage boundaries as determined by the Regional Water Quality Control Board, San Diego Region (AEC et al., 2004).

Soils

The Santa Margarita Watershed is comprised of a variety of soils but is dominated by loam throughout the watershed. Certain areas within the watershed are comprised of other soil units (AEC et al., 2004). These areas include:

- Sand in the Santa Margarita Estuary
- Sand and clay in the Ysidora
- Rock outcrops in the De Luz
- Broken and gullied land in the Temecula-Murrieta
- Gullied and rough broken land, badlands, rock outcrops, and sand in the Vail
- Rock outcrops in the Skinner

In general the predominance of loamy soils within the watershed leads to extremely dry soils during the summer months, very high initial abstractions during the first precipitation of each water year, and flashy episodic flows in the primary channels of the watershed.

Vegetation

The Santa Margarita Watershed includes a diverse range of vegetation communities, due in part to its varied topography and mild climate. These vegetation communities include the following: coastal fringe environments, inland and freshwater wetland/riparian habitats, low elevation shrub lands, fields and grasslands, high elevation shrub lands, coastal lowland oak woodlands, high foothill and mountain habitats, vernal pools, agricultural and exotic landscapes, and developed and urbanized lands (AEC et al., 2004).

Land Use

The lower portions of the Santa Margarita Watershed are largely undeveloped due to steep topography and public ownership by the United States Marine Corps. The upper watershed on the other hand is rapidly urbanizing. Land use patterns within the watershed are somewhat heterogeneous, including areas of residential, agriculture, and other developed urban uses, surrounded by larger areas of open space and undeveloped/vacant lands (AEC et al., 2004). Table 5.3 shows land use acres and percentages in each city/county within the watershed based on 2004 parcel data.

Table 5.3 Land Use within the Santa Margarita Watershed (AEC et al., 2004)

	San Diego County	Oceanside	Temecula	Murrieta	Hemet	Riverside County	Total	Percent of SMRW
Rural Family Housing	2,622	-	4	4	-	324	2,954	0.6%
Single Family Housing	829	0	4,730	4,690	-	24,670	34,918	7.3%
Multi Family/Mobile Homes	524	-	572	1,432	-	14,228	16,756	3.5%
Other Group Quarters	91	0	30	10	-	65	195	0.0%
Schools	64	0	275	92	-	35	466	0.1%
Recreation	806	89	415	519	-	1,338	3,168	0.7%
Commercial/Retail	942	-	659	377	-	325	2,303	0.5%
Office	22	-	101	31	-	8	162	0.0%
Public Services	50	-	65	86	-	276	477	0.1%
Medical	44	-	16	41	-	27	127	0.0%
Industrial/Storage	281	-	617	157	-	104	1,158	0.2%
Mining/Extractive Uses	6	-	-	-	-	911	917	0.2%
Aviation	410	-	-	-	-	-	410	0.1%
Transportation/Utilities	1,154	8	2,662	2,718	1	8,114	14,657	3.1%
Non-Irrigated Agriculture	5,246	-	942	220	-	12,539	18,946	4.0%
Irrigated Agriculture	-	-	489	55	3	2,141	2,688	0.6%
Orchards/Vineyards	5,502	-	0	51	-	13,391	18,944	4.0%
Intensive Agriculture	4,727	-	21	464	-	6,878	12,090	2.5%
Water Bodies	194	-	-	-	0	6,854	7,049	1.5%
Tribal Reservations	875	-	164	-	-	15,230	16,269	3.4%
Military Uses	32,491	-	-	-	-	-	32,491	6.8%
Open Space Preserves	19,002	-	-	-	-	-	19,002	4.0%
Undeveloped Land/Vacant	50,623	1	8,193	10,109	13	202,374	269,313	56.6%
	126,503	**98**	**17,955**	**21,054**	**17**	**309,832**	**475,459**	

Source: January 2004 Riverside County Parcel Data and 2002 SANDAG Land Use – KTUA modifications focused on Military, Tribal, Water, and Undeveloped lands.

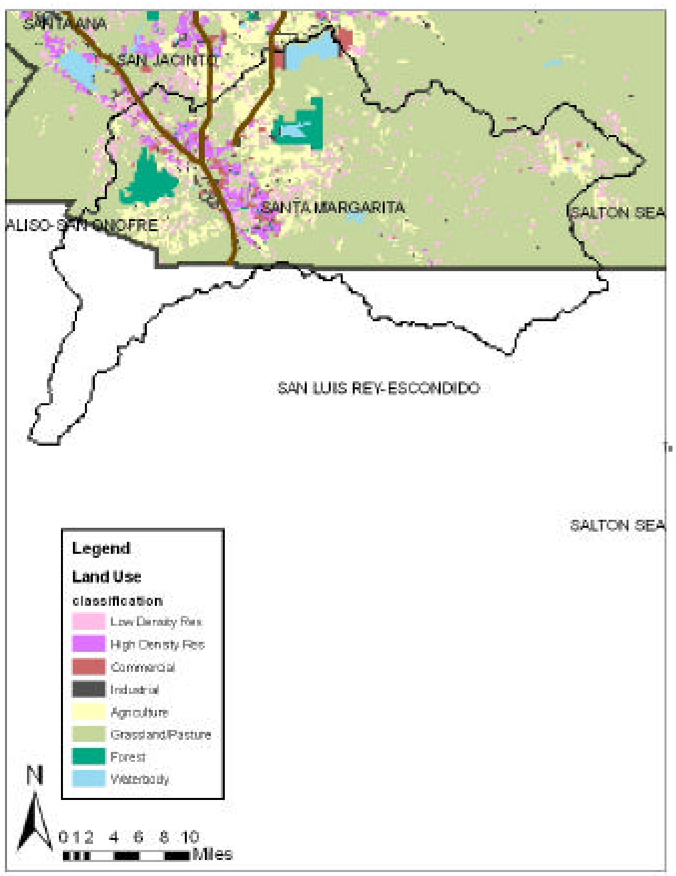

Figure 5.14 Land use in the Santa Margarita River watershed (SCAG, 2003; Spatial data available only for SCAG area, Riverside County)

The population in the Santa Margarita Watershed is projected to grow by between 277% and 475% by the year 2030. This growth will result in a projected population of between 500,000 and 850,000 residents making their homes in the watershed. With vast areas of open space, development and growth will come rapidly to the SMRW. The Upper Santa Margarita River Watershed is one of the fastest growing urban areas in California (AEC et al., 2004).The Cities of Murrieta and Temecula, located in the central portions of the watershed, comprise the majority of existing urban land uses in the watershed. The unincorporated communities of Wildomar, Anza, Fallbrook, Aguanga, and Warner Springs contain the majority of rural, single and multi-family housing. The largest land use within the watershed is undeveloped lands (vacant, rangelands, and pastures) encompassing approximately 62 percent of the watershed (AEC et al., 2004).

Beneficial Uses

Table 5.4 shows the beneficial uses designated for the SMRW. Water quality objectives must aim to protect the most sensitive beneficial use designated for the particular water body. The beneficial uses that require the most stringent standards within the SMRW include municipal and domestic water supply, contact, recreation, and provision of habitat.

Table 5.4 Designated Beneficial Uses (AEC et al., 2004)

Beneficial Uses	Inland Surface Waters	Coastal Waters	Reservoirs and Lakes	Groundwaters
Municipal and Domestic Supply (MUN)	•		•	•
Agricultural Supply (AGR)	•		•	•
Industrial Service Supply (IND)	•		•	•
Industrial Process Supply (PROC)	•		•	•
Groundwater Recharge (GWR)	☐		•	
Navigation (NAV)				
Contact Water Recreation (REC-1)	•	•	•[1]	
Non-contact Water Recreation (REC-2)	•	•	•	
Commercial and Sport Fishing (COMM)				
Warm Freshwater Habitat (WARM)	•		•	
Cold Freshwater Habitat (COLD)	•		•	
Biological Habitats of Special Significance				
Estuarine Habitat (EST)		•		
Wildlife Habitat (WILD)	•	•	•	
Biological Habitats		•		
Rare, Threatened, or Endangered Species (RARE)	•	•	•	
Marine Habitat (MAR)		•		
Migration of Aquatic Organisms MIGR)		•		
Aquaculture (AQUA)				
Shellfish Harvesting (SHELL)				
Spawning, Reproduction and/or Early Development (SPWN)				

Notes: • = Existing ☐ = Potential
[1] Shore and boat fishing only. Other REC1 uses prohibited.
Source: SDRWQCB 1994

Impairments/ Areas at Risk

Currently Rainbow Creek, Sandia Creek, Murrieta Creek, the Upper Santa Margarita and the Santa Margarita Lagoon are listed on the Clean Water Act's 2002 303 (d) listing for either nutrients or total dissolved solids (TDS). Nutrient loading to Rainbow Creek, Murrieta Creek, 18 miles of the Upper Santa Margarita and the Santa Margarita Lagoon comes from a variety of sources including agriculture, nursery operations, municipal wastewater discharge, and urban runoff. Sources of TDS loading to Sandia Creek include urban runoff/storm drains, flow regulations/modifications, natural sources, and unknown point and non-point sources (SDLEG, 2003).

Constituents of Concern

Potential water quality issues for the Santa Margarita Watershed include eutrophication (associated with low dissolved oxygen, and the presence of solids and excessive nutrients), toxic substances (trace elements and synthetic organics), diazinon contamination, and high levels of total dissolved solids. Other notable water quality and environmental concerns include excessive sedimentation from development and agriculture areas, groundwater degradation and contamination from nitrates and other salts, habitat loss, channelization, flooding and riverbank scour (AEC et al., 2004).

Potential RTP Impacts in Santa Margarita watershed

The Santa Margarita Watershed currently has a low level of development. The three major RTP projects planned for this watershed have the potential for significant water quality impacts. If the rate of urbanization continues to accelerate there will be considerable stresses on the watershed created by the rising pollutant loads that are directly associated with growth and human activities.

6. ORANGE COUNTY

6.1 General description of the area

Orange County (Figure 6.1), with a population of 2,978,816, has 34 cities within its boundaries. The expected population growth by 2030 is 19%, to above 3.55 million. The County is comprised of thirteen watersheds: Coyote Creek, Carbon Creek, Westminster, Talbert, Santa Ana River, San Diego Creek, Newport Bay, Newport Coast, Laguna Canyon, Aliso Creek, Salt Creek, San Juan Creek, and San Clemente (Figure 6.2). These watersheds are within the jurisdiction of the Santa Ana and San Diego Regional Water Quality Control Boards, the state agencies that regulate surface water quality through the issuance of stormwater and other discharge permits. Regional Board 4 also has jurisdiction over a few subwatersheds in Orange County, as indicated in Appendix G. The case study of the Santa Ana River presented in Section 5 applies to this county as well. We also include a case study for the San Gabriel River Watershed.

Table 6.1 Proposed RTP Projects within Orange County

RTP ID	Route/Program	From	To	Description	Watershed	Subwatersheds (HSU)
2M01124	SR-91 EB/WB	Truck scales	Imperial	Add storage lane at truck weigh in motion station	18070203	801.11, 801.13
2M01117	SR-57 NB	Orangethorpe	Lambert	MF or Aux Capacity	18070106	845.61, 845.62, 845.63
2M01118	SR-57 NB	at SR-91		Add 4th through lane	18070106	845.61
2M04121	SR-91 EB/WB	SR-55	Riverside County Line	Add 1 MF lane each direction	18070203	801.11, 801.13
2TK01116	SR-57 NB	Lambert	Tonner Canyon Road	Truck Climbing Lane	18070106	845.62
2T01135	SR-91/SR-241	-	-	Add direct toll-to-toll or HOV connection from north/south SR-241 to SR-91 toll lanes to/from the east	18070203	801.13
2H01143	I-5 NB/SB	Coast Highway	Pico	Add 1 HOV lane each direction	18070301	901.2, 901.3
ORA000193	SR-22/I-405	-	-	HOV Connector	18070201	801.11
2H01145	I-405/I-605	-	-	HOV Connector	18070106	845.61
2H01148	I-405	at Von Karman	-	HOV Drop Ramp	18070204	801.11
2T04136	SR-91	SR-241	SR-71	Add toll lane and toll connection at SR-71 (RIV) (per Four Corners Study)	18070203	801.13
2M04132A	I-405	SR-73	Beach	Add 1 MF lane each direction	18070201, 18070203	801.11

6.2 Proposed RTP Projects

There are 12 proposed RTP projects within Orange County (Table 6.1). Figure 6.3 presents the location of each proposed RTP project within Orange County. Several of the RTP projects involve only HOV connectors or toll connections, although a number also involve additional lanes, with potentially a greater impact. The overlay of RTP projects and watersheds in Orange County is presented in Figure 6.4.

6.3 Current Impairments and TMDL Prioritization

The watersheds in Orange County are listed as impaired for almost every category except trash, which is surprising, since the coastal areas are certainly associated with trash accumulation. Figures 6.5 to 6.10 present the priorities of the impairments due to Metals (Fig. 6.5), Pathogens (Fig. 6.6), Sediments (Fig. 6.7), Toxics other than pesticides (Fig. 6.8), Pesticides (Fig. 6.9), and Nutrients (Fig. 6.10). Pesticide contamination ranks high in priority in Orange County. In particular, the lower Santa Ana Watershed has been identified as a high TMDL priority for several contaminants, and there is a significant overlap with the RTP projects in these areas. Metals and pathogens are ranked as medium priority in Orange County. The impact of suspended sediments and nutrients is generally ranked as a lower priority by the RWQCB.

6.4 Flood risks from RTP Projects

Figure 6.11 presents the flood risk information for Orange County. The RTP project 2M04132A cuts across a high flood risk area, so it is of particular concern. The other RTP projects in the County are located in areas of low flood risk.

6.5 Potential Storm Water Impacts from RTP Projects

Given the relatively small size of this county, and the very high level of urbanization, the number of proposed RTP projects is substantial. Although the overall length of new highway surface is moderate, the location of some of the RTP, with regards to existing impairments and stressed conditions, can lead to impacts on water quality. In particular project 2M04132A can have a substantial impact on water quality given its location relative to the nearby water body.

6.6 Potential for Planning and Coordination

For projects in Orange County, the majority involve three or more cities, except the HOV connector projects which are essentially points in the highway network. The cities of Anaheim, Yorba Linda, Seal Beach, Huntington Beach, Fountain Valley, Placentia, Fullerton and Costa Mesa will be important planning and coordination partners. Most of these projects involve HOV lanes or connectors, additional truck lanes or toll lanes and toll lane connectors, which will generally have fewer water quality implications than an entirely new highway. In those cases where a proposed project is close to city boundary lines we have identified two or more cities which might be prospects for a local partnership.

As in previous reports, we have highlighted the Santa Ana Watershed, since it will be the most impacted by the proposed RTP projects. As mentioned above, the Santa Ana Watershed Project Authority (SAWPA) can be a significant planning ally and resource in this watershed.

6.7 Case Study: San Gabriel River Watershed

Watershed Description

The San Gabriel River Watershed is located in the eastern portion of Los Angeles County. It is bounded by the San Gabriel Mountains to the north, San Bernardino and Orange County to the east, the division of the Los Angeles River from the San Gabriel River to the west, and the Pacific Ocean to the south. The watershed is composed of approximately 640 square miles of land, with 42% of its total area developed. In addition, the watershed has 132 miles of streams; 806 acres of lakes, ponds, and reservoirs; 9.5 miles of coastal waters; and 47 acres of wetlands. The watershed lies mostly within Los Angeles County with small portions in San Bernardino and Orange Counties.

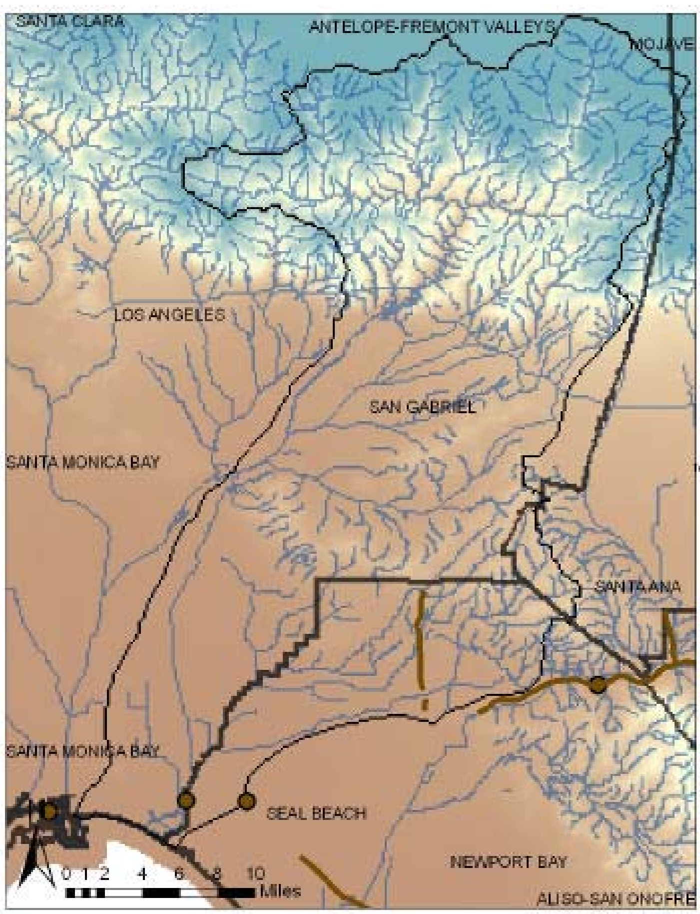

Figure 6.12 Map of San Gabriel Watershed

In the upper reaches of the watershed, the San Gabriel River drains undisturbed riparian and woodland habitats, much of which has been designated as a wilderness area by the U.S. Congress. Areas in the upper watershed are subject to heavy recreational use such as hiking, mountain biking, and camping. The upper watershed also contains a series of reservoirs with flood control dams: the Cogswell, San Gabriel, and Morris Dams, going downstream. These dams have been authorized for recreational purposes but are primarily for flood control purposes. The sediment that accumulates behind them is periodically removed to maintain flood capacity.

After the San Gabriel flows out of San Gabriel Canyon, it is retained by the Santa Fe Dam and Reservoir. The Santa Fe basin, which stretches behind the dam, has been designated as sensitive habitat. The basin is also maintained as a spreading ground, where stormwater and imported water recharge the groundwater supply (San Gabriel EIR, 2005).

Below the Santa Fe Dam, the San Gabriel River is soft-bottomed with riprap sides before it encounters Whittier Narrows Dam. Like the Santa Fe Dam, the Whittier Narrows Dam is also for flood control and also has some designated recreational uses. Immediately downstream of the dam is the Montebello Recharge Facility that uses reclaimed water to supplement local surface water for replenishing the Central Basin Aquifer.

In the lower part of the watershed, the San Gabriel river flows through a concrete-lined channel in a heavily urbanized portion of Los Angeles County before becoming a soft bottom channel once again near the ocean in the city of Long Beach.

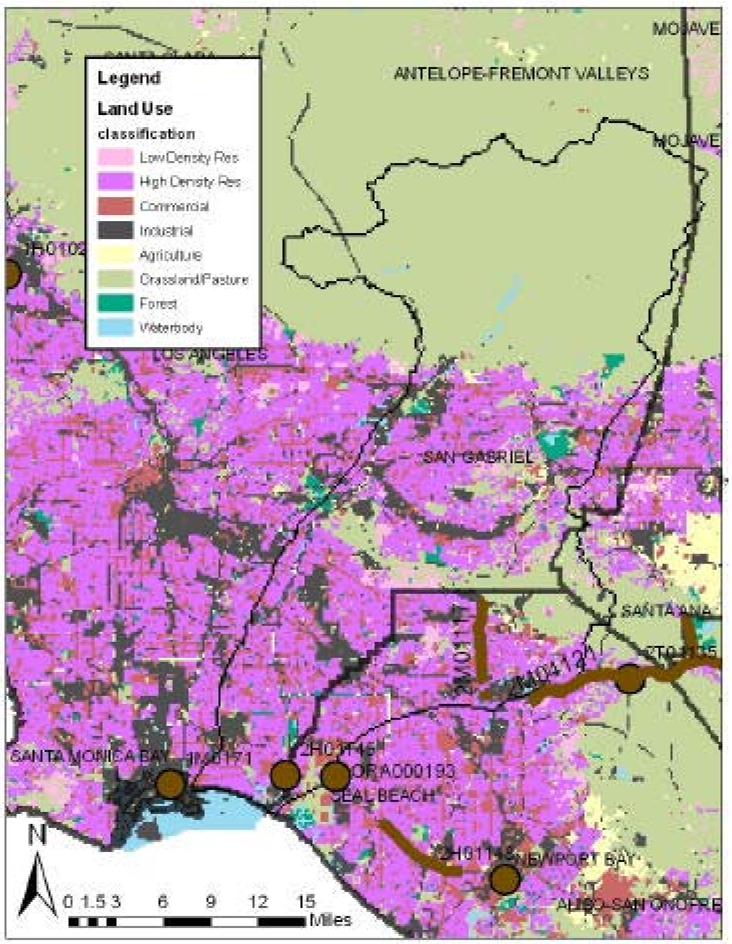

Figure 6.13 Land use in the San Gabriel River watershed

Land Use

In the upper reaches of the SGRW at elevations above 3,000 feet, the San Gabriel Mountains consist primarily of conifer dominated forests and woodland. Just above 3,000 feet, Coulter pine (*Pinus coulteri*) and canyon live oak (*Quercus agrifolia*) are the dominant tree species, and the area has an open park-like feel. It is often used as rangeland. Farther upslope, upper montane conifer forests are present, consisting of white fir (*Abies concolor*) and sugar pine (*Pinus lambertiana*). At the highest elevations in the San Gabriels Mountains are the montane juniper (*juniperus scopulorum*) woodland on open slopes and ridges and lodgepole pine (*Pinus contorta*) forest on flats and gentle slopes.

Below 3,000 feet elevation in the foothills of the San Gabriel Mountains is the chaparral ecosystem. A chaparral community consists of densely-growing evergreen oaks and other drought-resistant shrubs. It often grows so densely that it is all but impenetrable to large animals and humans. This density, and its generally arid condition, makes the chaparral ecosystem notoriously prone to wildfires. The most common chaparral plant species is chamise (*Adenostoma fasciculatum*). Other important shrubs include scrub oak (*Quercus berberidifolia*), manzanitas (*Arctostaphylos spp*.), and ceanothus (*Ceanothus spp.)* species (SCAG, 2004).

Below 1,000 feet, the chaparral ecosystem ends and the rest of the watershed all the way to the ocean is almost completely developed. The majority of development is residential, though commercial and service development makes up a substantial amount of the land cover. There is also a minimal amount of agricultural land in the lower elevations of the watershed.

There are seven major types of soils in the San Gabriel Watershed. In the San Gabriel Mountains, the primary soil types are silt loam and sand (SCAG, 2004). At the base of the San Gabriel Mountains is the San Gabriel Basin, which is dominated by unconsolidated to semi-consolidated alluvium deposited by streams flowing out of the San Gabriel Mountains. The alluvial soil is very porous, and as a result, provides a permeable connection between the surface and the aquifer. The basin soil is composed primarily of sandy loams, silt loams, and clay loams. In the lower part of the watershed is the Los Angeles Coastal Plain, which is a predominately sandy loam soil.

Roads

Roads can be a significant source of metals which find their way into surface water bodies. To a lesser degree, roads are also a source of hydrocarbons. The road network in the SGW is extensive, particularly in the lower reaches near Long Beach. Higher up in the watershed in the San Gabriel Mountains there are several major roads; all are paved although sometimes very winding, steep and narrow. The main route is the Angeles Crest Highway which climbs steadily and peaks at 7,900 feet. Another road into the San Gabriel Mountains is highway 39 which used to connect with the Crest but it has been closed for many years due to numerous landslides. Other major roads include Interstate 10, Interstate 5, and Highway 605, all of which traverse the more developed flatlands of the watershed.

Beneficial Uses

The current state of the watershed is critically affected by its land and water uses. Beneficial uses of the waters within SGW include:

Estuary	*Above Estuary*
Contact & non-contact water recreation	Contact & noncontact water recreation
Industrial service supply	Industrial service supply
Protection of rare & endangered species	Protection of rare & endangered species
Wildlife habitat	Wildlife habitat
Spawning	Spawning
Marine habitat	Warm- & coldwater habitat
Estuarine habitat	Municipal water supply
Navigation	Groundwater recharge
Commercial & sportfishing	Industrial process supply
Migratory	Agricultural supply

Water Quality

The San Gabriel River Watershed has 12 waters listed as impaired on the Clean Water Act's 2002 303(d) listing (USEPA). These water bodies are not achieving their designated uses because of 45 impairments caused by 21 different pollutants of concern. The most frequently listed impairment is high coliform count (5 listings), followed by copper, lead and toxicity (4 listings each). Abnormal fish histology, zinc, and algae are listed three times each. There are several industrial and wastewater discharge points throughout the watershed. Because agriculture and grazing are minimal land uses, nonpoint sources are probably from urban runoff. High coliform counts could be a result of the grazing that does occur in the watershed, as well as sewage discharge. The remaining impairments are probably a result of industrial loading.

Development Trends

Outward development of the urban center within the watershed is limited because of the mountain range surrounding the LA metropolitan area, and upward development is limited because of the earthquake potential in the area. Despite this, the area within the watershed continues to grow both economically and in terms of overall population. The development exists within a confined area. Employment trends have shown an increase particularly in the service industry as population density increases (Urban Research Division, LA County, 2001). Recently, this has meant an increase in urban pollution affecting the watershed (primarily trash), and decreased recreational or wildlife space.

Future Projections

California as a whole is expected to see a dramatic increase in population over the next 15 years (US Census Bureau, 2000). With a growing population and continued development, land use changes are expected to be seen most severely as an increase in industrial use and a decrease in agricultural uses. The watershed is expected to increase its industrialization, reducing agriculture and pasture lands.

The increased population and development will have two major impacts: the increased demand in municipal water use and the pressures for increased outdoor recreational activities. Increased demand for water is important given concerns about competition for reliable water supplies, as well as other "big picture" concerns about the impact of trends in climate change. Additional demand for recreational activities will result in the increased impact of human visitors in critical habitat, especially in the San Gabriel Mountains. Secondly, the increased industrial development and the decreased amount of open space in the SGW may significantly impact both ground and surface waters. More industrial development means that surface permeability of the watershed will decrease, which will result in reduced groundwater recharge and increased runoff after storm events. Additionally, we can expect additional impairments to surface and ground water caused by heavy metal and hydrocarbon influxes.

Potential RTP Impacts in San Gabriel River Watershed

There is only one proposed RTP project for the San Gabriel Watershed. The project involves an HOV connector. Therefore, the impact of the RTP projects is minimal in this watershed.

7. SAN BERNARDINO COUNTY

7.1 General description of the area

San Bernardino County (Figures 7.1 and 7.2), with a population of 1,832,966, has 24 cities within its boundaries. Population growth will be on the order of 48%, to reach over 2.71 million by 2030. The County is comprised of 15 watersheds: Antelope-Fremont Valleys, Coyote-Cuddeback Lakes, Death Valley-Lower Amargosa, Havasu-Mohave Lakes, Imperial Reservoir, Indian Wells-Searles Valleys, Ivanpah-Pahrump Valleys, Mojave, Panamint Valley, Piute Wash, Salton Sea, San Gabriel, Santa Ana, Southern Mojave, and Upper Amargosa (Figure 7.3),. These watersheds are mostly within the jurisdiction of the Santa Ana, Lahontan and the Colorado River Basin Regional Water Quality Control Boards, the state agencies that regulate surface water quality through the issuance of stormwater and other discharge permits. Regional Board 4 also has jurisdiction over a few subwatersheds in San Bernardino County.

The majority of the RTP projects in San Bernardino County fall within the upper Santa Ana River Watershed, which was described in the case study in Section 5.

7.2 Proposed RTP projects in the County

There are 18 RTP projects planned for San Bernardino County (Table 7.1). As shown in Figure 7.4, most of the proposed projects are within the southwest corner of the County, near the Riverside and Los Angeles County borderlines. A number of proposed RTP projects fall within a small section of the Santa Ana River watershed, between Riverside and San Bernardino Counties, as shown in Section 5.7 and Figure 7.5. A few RTP projects also fall within the Mojave watershed.

7.3 Current Impairments and TMDL Prioritization

The cause of impairment in San Bernardino County watershed is presented in Figures 7.6 to 7.8, which present impairment due to Pathogens (Fig. 7.6), Sediments (Fig. 7.7), and Nutrients (Fig. 7.8). In the two most impacted subwatersheds (HSU 801.21 and 801.71), these three classes of impairments are high priority. A number of RTP projects fall within HSU 801.21.

7.4 Flood risks with RTP Projects

Figure 7.9 presents the flood risk information for San Bernardino County. The highest risk is in the upper Santa Ana River region, in HSU 801.21. This is of concern, since a number of RTP projects are planned for this area.

7.5 Potential Stormwater Impacts from RTP Projects

Many of the proposed RTP projects in San Bernardino County fall within the upper Santa Ana River Watershed, which is already impaired due to pathogens, sediments and nutrients. The additional load of metals, toxics and other substances from the additional highway surfaces can have a significant impact on water quality. For example, Project 4H01004 and Project 4H01010 fall within an area already impaired and are likely contribute to additional stress on the waterbody in HSU 801.21 unless planning prevents this occurrence.

Table 7.1 Proposed RTP in San Bernardino County

RTP ID	Route/Program	From	To	Description	Watershed	Subwatersheds (HSU)
4T01003	I-15	Devore	Summit	Truck Climbing Lane	18070203, 18090208	628.2, 801.51, 801.52
4H01007	I-215	Riverside County Line	I-10	Add 1 HOV lane each direction	18070203	801.27, 801.44
4M04001	I-215	Riverside County Line	I-10	Add 1 MF lane each direction	18070203	801.27, 801.44
4M04200	I-10 WB	Yucaipa Bl	Ford St	Add 1 MF lane westbound	18070203	801.55, 801.56
4H01001	I-10	I-15	SR-38	Add 1 HOV lane each direction, widen UC's, reconstruct ramps	18070203	801.21, 801.27, 801.44, 801.52, 801.53
4H01002	I-10	SR-38	Yucaipa Bl	Add 1 HOV lane each direction	18070203	801.53, 801.55, 801.56, 801.61
4H01005	I-15	I-215	US-395	Add 1 HOV lane each direction	18070203, 18090208	628.2, 801.51, 801.52
4H01006	I-15	US-395	D St	Add 1 HOV lane each direction	18090208	628.2
4M01005	SR-210	I-215	I-10	Add 1 MF lane each direction and widen UC's	18070203	801.52
4A01900	SR-18	Los Angeles County Line	US 395	Widen from 1 to 2 lanes each dir	18090206, 18090208	626.8, 628.1, 628.2
4H01003	I-10	Yucaipa Bl	Riverside County Line	Add 1 HOV lane each direction	18070203	801.61, 801.64, 801.67
4H01004	I-15	Riverside County Line	I-215	Add 1 HOV lane each direction	18070203	801.21, 801.42, 801.43, 801.52, 801.59
4H01008	I-215	SR-30	I-15	Add 1 HOV lane each direction	18070203	801.52
4H01009	I-10/I-215	South to East/East to South	-	HOV Connector	18070203	801.44
4H01010	I-10/I-15	South to West/West to South	-	HOV Connector	18070203	801.21
4H01011	I-10/I-15	North to West/West to North	-	HOV Connector	18070203	801.21
4M01003	I-215	SR-30	I-15	Add 1 MF lane each direction	18070203	801.52

7.6 Potential for Planning and Coordination

The proposed RTP projects in San Bernardino County are generally focused on the western portion of the county. Most of these projects involve significant extensions of existing highways, as well as a combination of new HOV lanes or connectors and additional truck lanes. Along with the County, the cities most suited to be involved in cooperative water quality planning efforts include San Bernardino, Rialto, Fontana, Colton, Yucaipa, Rancho Cucamonga, Ontario, Hesperia, Victorville and Adelanto.

8. IMPERIAL COUNTY HYDROLOGY AND JURISDICTIONS

8.1 General description of the area

Imperial County (Figure 8.1), with a population of 150,909, has 7 cities within its boundaries. The population in Imperial County is expected to grow to around 270,000 by 2030, or an increase of 79% (SCAG, 2004). The County includes portions of 4 watersheds: Imperial Reservoir, Lower Colorado, Salton Sea, and Southern Mojave (Figure 8.2). These watersheds are within the jurisdiction of the Colorado River Basin Regional Water Quality Control Board.

8.2 Proposed RTP projects

The four proposed RTP projects in San Bernardino are mostly in unincorporated areas, but involve construction of significant highway extensions (Table 8.1). Figure 8.3 presents the location of each proposed RTP project within Imperial County, and Figure 8.4 presents the overlay of RTP projects and watersheds.

Table 8.1 Proposed RTP in Imperial County

RTP ID	Route/Program	From	To	Description	Watershed	Subwatersheds (HSU)
6M0400E	SR-115	I-8	Evan Hewes Hwy	Construct 4-lane extension	18100200	723.1
6M01004	SR-111	SR-78 (Brawley)	SR-115 (Calipatria)	Upgrade to 4-lane conventional	18100200	723.1
6M04018	Dogwood Rd Corridor / I-8 Overpass	SR-98	I-8	Corridor improvements - widen to 6 lanes from McCabe to I-8; I-8 improvement to 6 lanes	18100200	723.1
6M01003	SR-111	SR-98	I-8	Upgrade to 4-lane freeway with interchange(s) at several locations	18100200	723.1

8.3 Current Impairments and TMDL Priorities

Impairment in Imperial County is mostly due to Pathogens (Figure 8.5), Sediments (Figure 8.6), Toxics other than pesticides (Figure 8.7), Pesticides (Figure 8.8), Nutrients (Figure 8.9), and Trash (Figure 8.10). The highest priorities are impairments due to sediments and nutrients in the Salton Sea watershed. The four projects in Imperial County coincide with impaired subwatersheds within the Salton Sea watershed and warrant careful pollution control planning.

8.4 Flood risks with RTP Projects

Figure 8.11 presents the flood risk for Imperial County. There is an unexplainable discontinuity in flood risk across the county line, with unknown risk in Riverside County and high risk in Imperial County. The risk is mostly associated with the Salton Sea, which tapers off as it goes into Riverside County, but it appears that the discontinuity is due to political jurisdiction, rather than physical differences across the county line. There is also high flood risk associated with some of the washes in southwestern Imperial County (e.g. Carrizo Wash), and the region east of the Salton Sea which discharges east to the Milpitas Wash. Although these regions experience very low precipitation, it can be delivered in a short event during the wet season, potentially leading to flooding.

The only significant RTP project in a high flood risk area corresponds to Project 6M01004. This project will upgrade SR 111 to a four lane conventional expressway, which crosses right below the lower Salton Sea area. The impact of this project is expected to be low to moderate in terms of storm runoff, mainly due to the very low precipitation experienced in this area.

8.5 Potential Storm Water Impacts from RTP Projects

The proposed RTP projects for Imperial County involve significant new highway surfaces over relatively undeveloped areas. The Salton Sea watershed already exhibits impairments due to most classes of pollutants, so preventive measures need to be considered for these four RTP projects in the area.

8.6 Potential for Planning and Coordination

Imperial County has four proposed RTP projects that are located mainly within the jurisdiction of county agencies. However, the cities of Calexico, El Centro, Brawley and Calipatria are potential partners in the planning and implementation of related pollution control measures.

9. CONCLUSIONS AND RECOMMENDATIONS

This study evaluated the potential for water quality and stormwater impacts associated with the major proposed projects identified in SCAG's 2003 RTP. The analysis considered watershed characteristics, such as topography, soil type, climate, flood plains, existing vegetation, land use and imperviousness. The analysis also took into account the current impairments due to a wide number of pollutants, classified into eight major classes, and the associated TMDL priorities, as identified by the governing Regional Water Quality Control Boards. In addition, our analysis estimated the surface characteristics and area of the RTP projects to calculate, using recent CalTrans studies, the average Event Mean Concentrations for stormwater runoff from the different types of highway surfaces. Finally, the project considered the location of the projects in relation to potential partners that may have a shared interest in planning and implementing pollution control measures.

The key findings of the study are:

- A significant fraction of the RTP projects are located within the Santa Ana River watershed and involve the counties of Riverside, Orange and San Bernardino, as well as numerous cities. Since the proposed projects include significant extensions of highways and/or new lanes, with an increase of hundreds of miles of highway surface, the potential for increase runoff and associated pollutant loadings is high. In addition, a number of the projects cross the River or its tributaries, and lie near the flood plain. The watershed is listed for a significant number of impairments, within most of the categories of pollutants that may be generated by highways. Discharge from outfalls should be treated to minimize impact on the receiving water bodies. In addition, some of the projects are within high flood risk zones.
- The Santa Margarita River watershed will also be the recipient of an important number of projects, of particular concern since this watershed is relatively undeveloped, and the proposed projects may have direct and indirect impacts due to new construction, as it becomes easier to drive to this area. Two major new highways surfaces are planned within the watershed, with the potential for significantly increasing pollutant loadings. The projects are mostly located in unincorporated areas of Riverside County, but potential planning partners for the County can include the cities in the watershed that will benefit from the highways.
- Two major watersheds in Ventura County, the Ventura River and Calleguas Creek, will be the recipient of one new RTP project each. Calleguas Creek in particular is under significant stress from a water quality perspective, since many of it's reaches are listed as impaired for every major class of pollutants. The Calleguas Creek Watershed Management Plan is a significant model for cooperative and comprehensive planning in the SCAG region.
- The four RTP projects in Los Angeles County have small footprints and should be a minor source of pollutant loading in their draining areas.

As projects mature further partner identification is recommended. These actions can be taken not only in the context of the TMDL mandates, but can also be taken proactively before they become part of a water quality enforcement.

10. APPENDIX A: METHODS AND DATA SOURCES

10.1 Assessing Water Quality Implications for the RTP Projects

The methodology presented in this report, which considers identifying key characteristics in the proposed RTP projects, as well as environmental conditions in the area surrounding these projects, such as soil characteristics and observed meteorological conditions, can be used to evaluate future projects and determine the potential storm water pollutant load from each project, before mitigation or treatment design. This methodology can also serve as a template for other regions across the state where CalTrans projects are being considered.

An assessment of each project is then performed based on the characteristics of the watershed(s) and subwatershed(s), involving meteorology, soils and surrounding land-use. As an example, those Projects located in areas with higher rainfall and/or more erodable soils will likely lead to increased storm water pollutant loadings in the form of sediments. Using statistics from CalTrans water quality monitoring programs, we then make a preliminary estimate of the pollutant loading that might result from the proposed RTP projects. It should be noted that these estimates are based on prior statistics, and do not reflect any mitigation or treatment technologies that may be considered during the design phase. In addition, in the case of projects that are enhancements of a particular highway, it is not possible at this time to estimate whether the enhancement will increase the traffic load, and the possible impact from this. The estimate simply considers the new highway surface area and the potential for runoff to transport pollutants from the highway.

To estimate the loading potential from the proposed RTP projects, the length and width of the project are important factors. Table 1-3 also provides the estimated length and width of each project.

The potential of each RTP project to generate contaminated stormwater is a function of project and watershed/subwatershed characteristics. The November 2003 CalTrans Discharge Characterization Study (CTSW-RT-03-065.51.42) provides an excellent synthesis of the typical pollutant concentrations from highways in California, for a wide range of pollutants. In addition, correlations between pollutant concentration and a number of factors, such as vehicular traffic, precipitation characteristics, drainage area and impervious fraction.

Some of the key findings from that study are:

- Pollutant concentrations in stormwater runoff increase with higher traffic levels (measured as AADT).
- Higher cumulative annual or storm event precipitation results in lower pollutant concentrations, possibly due to increased washing of the surfaces.
- Pollutant concentrations increase after a long antecedent dry period, since pollutants build-up on the surface.
- Larger drainage areas tend to result in lower concentrations of some pollutants.
- Impervious fraction of the drainage area did not have a consistent effect on pollutant concentrations.

The summary statistics for pollutant concentrations measured in highway stormwater runoff are presented for reference in Table A below.

Table A1: Summary Statistics for HIGHWAY FACILITIES (Statewide Characterization Studies Data, Monitoring Years 2000/01-2002/03)

Pollutant Category	Parameter	Units	n	number of sites	% Detected	Min Detected	Max Detected	Median	Mean	SD
Conventional	DOC	mg/L	635	46	100%	1.2	483	13.1	18.7	26.2
	EC	µS/cm	634	46	100%	5	743	72.7	96.1	73.4
	Hardness as CaCO3	mg/L	635	46	99%	2	400	26.9	36.5	34.2
	pH	pH	633	46	100%	4.47	10.1	7.0	7.1	0.7
	TDS	mg/L	635	46	97%	3.7	1800	60.3	87.3	103.7
	Temperature	°C	183	30	100%	4.7	25.4	12.0	12.5	3.4
	TOC	mg/L	635	46	100%	1.6	530	15.3	21.8	29.2
	TSS	mg/L	634	46	99%	1	2988	59.1	112.7	188.8
	Turbidity	NTU	—	—	—	—	—	—	—	—
Hydro-carbons	Oil & Grease	mg/L	49	10	29%	5	61	1.44	4.95	11.41
	TPH (Diesel)	mg/L	32	4	97%	0.22	13	2.52	3.72	3.31
	TPH (Gasoline)	mg/L	32	4	0%	ND	ND	ND	IDD	IDD
	TPH (Heavy Oil)	mg/L	20	4	95%	0.12	13	1.40	2.71	3.40
Metals	As, dissolved	µg/L	635	46	40%	0.5	20	0.7	1.0	1.4
	As, total	µg/L	635	46	62%	0.5	70	1.1	2.7	7.9
	Cd, dissolved	µg/L	635	46	42%	0.2	8.4	0.13	0.24	0.54
	Cd, total	µg/L	635	46	76%	0.2	30	0.44	0.73	1.61
	Cr, dissolved	µg/L	635	46	80%	1	23	2.2	3.3	3.3
	Cr, total	µg/L	635	46	97%	1	94	5.8	8.6	9.0
	Cu, dissolved	µg/L	635	46	100%	1.1	130	10.2	14.9	14.4
	Cu, total	µg/L	635	46	100%	1.2	270	21.1	33.5	31.6
	Hg, dissolved	ng/L	19	4	16%	2.5	110	IDD	IDD	IDD
	Hg, total	ng/L	23	4	39%	7.8	160	26.0	36.7	37.9
	Ni, dissolved	µg/L	635	46	79%	1.1	40	3.4	4.9	5.0
	Ni, total	µg/L	635	46	95%	1.1	130	7.7	11.2	13.2
	Pb, dissolved	µg/L	635	46	60%	1	480	1.2	7.6	34.3
	Pb, total	µg/L	635	46	94%	1	2600	12.7	47.8	151.3
	Zn, dissolved	µg/L	635	46	99%	3	1017	40.4	68.8	96.6
	Zn, total	µg/L	635	46	100%	5.5	1680	111.2	187.1	199.8
Micro-biological	Fecal Coliform	MPN/100 mL	32	5	97%	23	6000	362	1132	1621
	Total Coliform	MPN/100 mL	32	5	100%	34	160000	3966	13438	34299
Nutrients	NH3-N	mg/L	8	1	100%	0.33	3.9	0.77	1.08	1.46
	NO3-N	mg/L	634	46	90%	0.011	48	0.60	1.07	2.44
	Ortho-P, dissolved	mg/L	630	46	64%	0.014	2.4	0.06	0.11	0.18
	P, total	mg/L	631	46	89%	0.03	4.69	0.18	0.29	0.39
	TKN	mg/L	626	46	94%	0.1	17.7	1.40	2.06	1.90
Pesticide & Herbicides	Chlorpyrifos	µg/L	—	—	—	—	—	—	—	—
	Diazinon	µg/L	34	5	21%	0.1	1.33	0.04	0.13	0.29
	Diuron	µg/L	367	30	44%	0.5	220	0.37	4.60	18.24
	Glyphosate	µg/L	541	30	56%	5.1	164	8.88	19.61	26.97
	Oryzalin	µg/L	361	30	16%	0.5	77.8	IDD	IDD	IDD
	Oxadiazon	µg/L	365	30	5%	0.05	0.8	IDD	IDD	IDD
	Triclopyr	µg/L	367	30	2%	0.3	830	IDD	IDD	IDD
Semi-volitile Organics	Acenaphthene	µg/L	32	6	3%	0.25	0.25	IDD	IDD	IDD
	Acenaphthylene	µg/L	32	6	0%	ND	ND	ND	IDD	IDD
	Anthracene	µg/L	32	6	0%	ND	ND	ND	IDD	IDD
	Benzo(a)Anthracene	µg/L	32	6	0%	ND	ND	ND	IDD	IDD
	Benzo(a)Pyrene	µg/L	32	6	0%	ND	ND	ND	IDD	IDD
	Benzo(b)Fluoranthene	µg/L	32	6	3%	0.05	0.05	IDD	IDD	IDD
	Benzo(ghi)Perylene	µg/L	32	6	19%	0.05	0.17	IDD	IDD	IDD
	Benzo(k)Fluoranthene	µg/L	32	6	0%	ND	ND	ND	IDD	IDD
	Chrysene	µg/L	32	6	0%	ND	ND	ND	IDD	IDD
	Dibenzo(a,h)Anthracene	µg/L	32	6	0%	ND	ND	ND	IDD	IDD
	Fluoranthene	µg/L	32	6	19%	0.05	0.1	IDD	IDD	IDD
	Fluorene	µg/L	32	6	3%	0.06	0.06	IDD	IDD	IDD
	Indeno(1,2,3-c,d)Pyrene	µg/L	32	6	0%	ND	ND	ND	IDD	IDD
	Naphthalene	µg/L	32	6	0%	ND	ND	ND	IDD	IDD
	Phenanthrene	µg/L	32	6	9%	0.05	0.14	IDD	IDD	IDD
	Pyrene	µg/L	32	6	25%	0.06	0.13	0.05	0.05	0.03

Notes: "—" indicates parameter was not monitored for this facility category. "ND" indicates parameter was not detected. "IDD" indicates there were insufficient detected data to calculate statistic.

To estimate increased pollutant load, it is necessary to estimate runoff from a particular storm or from the annual average at the particular RTP project. Using the methodology presented in CalTrans Water Quality Planning Tool (http://stormwater.water-programs.com), the stormwater runoff from a highway is estimated using:

Volume of Runoff = Highway Area * Annual Precipitation * Runoff Coefficient

Highway Area = Length of Highway * Width of Highway * 1.25

For this project, we estimated a width of 25 ft for each new lane, and a typical runoff coefficient of 0.87. The length of the proposed RTP was estimated from the shapefile provided by SCAG. To cover additional area (median, service, etc.), we added 25% to the estimated area. The average annual precipitation was estimated from data collected at Spatial Climate Analysis Service (http://www.ocs.orst.edu/prism/), based on National Climatic Data Center information.

The characterization study by CalTrans (CTSW-RT-03-065.51.42) considered a large number of "conventional" pollutants, metals and organic chemicals and mixtures. For this work, we chose those which are commonly associated with impairment of a waterbody, such as Total Dissolved Solids (TDS), Total Suspended Sediments (TSS), Total Organic Carbon (TOC), Dissolved Organic Carbon (DOC), oils and greases, Total Petroleum Hydrocarbons (TPH), the total metal concentrations (which includes the dissolved fraction), fecal coliforms, and nutrients such as ammonia, nitrate, Total Kjeldahl Nitrogen (TKN) and phosphate. Other parameters such as pH, temperature, Electrical Conductivity and Hardness were not considered, since they are best used as very general indicators of water quality, rather than for impairment analysis. In addition, a number of pesticides and polyaromatic hydrocarbons (PAHs) listed in Appendix C-3 have non-detectable concentrations, or the sample size is too small to draw conclusions; they were not considered in our analysis.

The projected increase in pollutant loads for organic material, sediments, oils & greases, hydrocarbons, metals, fecal coliforms, nutrients, pesticides and polyaromatic hydrocarbons (PAHs) is presented in Appendix D-3, in metric units. Appendix D1-3 presents the data in English units, for reference. It should be noted that these estimates are very rough, given the simplifying assumptions with regards to width, additional area and precipitation.

In terms of overall load, sediments represent the major fraction, on the order of tens to thousands of kg/yr (lb/yr) in increased load. Organic matter is second in terms of mass load from highways, followed by hydrocarbons, either dissolved or as oils & greases. Nutrient loading from the highways is expected to be low, on the order of kg/yr (lb/yr), which would have a very minor impact even on impaired waterbodies. Metal and pesticide loads are on the order of g/yr (oz/yr); however, these contaminants might be toxic even at low levels, so the effect on overall toxicity needs to be evaluated in more detail.

10.2 Assessing Flood Risk Areas in SCAG

Data from the Federal Emergency Management Agency's National Flood Insurance Program was obtained to assess flood risk areas in the SCAG region. The data provided by FEMA corresponds to their Q3 Flood data. The digital Q3 Flood Data is a digital representation of certain features of FEMA's Flood Insurance Rate Maps, intended for use with GIS technology. The Q3 Flood data is designed to support planning activities, some Community Rating System activities, insurance marketing, and mortgage portfolio reviews. As indicated by FEMA, "the digital Q3 Flood Data cannot be used to determine absolute delineation of flood risk boundaries, but instead should be seen as portraying zones of uncertainty and possible risks associated with flood inundation. It does not provide base flood elevation information; thus, it has limited application for engineering analysis, particularly for site design or rating flood insurance policies for properties located within Special Flood Hazard Areas." Thus, caution should be used in interpreting the flood risks maps at this scale.

The flood risk zones are designated as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zone D

The Zone D designation is used for areas where there are possible but undetermined flood hazards. In areas designated as Zone D, no analysis of flood hazards has been conducted. Mandatory flood insurance purchase requirements do not apply, but coverage is available. The flood insurance rates for properties in Zone D are commensurate with the uncertainty of the flood risk.

Zones X and X500

Zone X are the flood insurance rate zones that correspond to areas protected from the 100-year flood and 500-year flood by levees.

10.3 Metadata of the Individual GIS Layers

Counties and County Equivalents Boundaries in the United States

Citation

Originator: U.S. Environmental Protection Agency/Office of Water/OST
Publication Date: 1998-02-27
Publication Place: Washington DC
Publisher: US EPA
Online Linkage: <http://www.epa.gov/OST/BASINS/>

Description

Abstract:

This coverage is of the county boundaries of the conterminous United States. It was derived from the U.S. Geological Survey State Boundaries, which were derived from Digital Line Graph (DLG) files representing the 1:2,000,000-scale map in the National Atlas of the United States.

Purpose:

This coverage is intended as a basemap for a variety of applications.

Time Period of Content:

Time Period Information:
Calendar_Date: 1994

Spatial Reference Information

Horizontal Coordinate System Definition:
Geographic:
Latitude Resolution: 0.0001
Longitude Resolution: 0.0001
Geographic Coordinate Units: Decimal Degrees

Geodetic Model:
  Horizontal Datum Name: North American Datum of 1983
  Ellipsoid Name: Geodetic Reference System 80
  Semi-major Axis: 6378137
  Denominator of Flattening Ratio: 298.257

City Boundaries (1990 TIGER)

Citation Information	
Title:	City Boundaries (1990 TIGER)
Originator:	Teale GIS Solutions Group
Publication Date:	1997-01-01
Other Citation Details:	This is NAD 27 datum in Albers projection. Measured unit in meters. Captue method unknown.
Identification Information	
Abstract:	The 'CITY90' layer contains 1990 Census Federal place code boundaries that have been clipped by the county tile outline. The Federal place codes define polygons that are cities or census designated places or are unclassified as to type.
Purpose:	To provide information about California city boundaries to the public.
Time Period:	Start: 1997-01-01 End: 1997-12-31
Currentness:	Publication Date
Progress:	Complete
Update Frequency:	Annually
Places:	Place Name of Bounding Box: California Other Place Names: California
Geographic Region:	West: -124.0000 East: -114.0000 North: 42.0000 South: 32.0000
Themes:	Cultural Geography, City boundaries,
Access Limitations:	No Restrictions
Use Limitations:	*No Redistribution*
Data Contact:	Metadata Administrator
Distribution Information	
Online Link:	http://gis.ca.gov/casil/gis.ca.gov/teale/city90a/
Metadata Information	
Date:	1997-12-24

Hydrologic Unit Boundaries of the Conterminous United States

Citation

  Originator: Environmental Protection Agency, Office of Water/OST
  Publication Date: 1998
  Publication Place: Washington DC
  Publisher: US EPA
  Online Linkage:
  USGS huc250k <http://water.usgs.gov/lookup/getspatial?/huc250k>
  EPA ESDLS
  BASINS model and data <http://www.epa.gov/OST/BASINS/>

Description

Abstract:

This metadata describes various delineations of watershed boundaries being stored in the EPA Spatial Data Library System (ESDLS). These delineations are based on the Hydrologic Unit Maps published by the U.S. Geological Survey Office of Water Data Coordination, together with the list descriptions and name of region, subregion, accounting units, and cataloging units. This metadata set describes the spatial data sets as they exist after downloading the data from ESDLS.

The changes made to the data sets from ESDLS are as follows:

- Reprojected the ARC/INFO coverages to a geographic projection.

- Derived accounting unit and cataloging unit layers only from original data.
- Convertted ARC/INFO coverages to Arcview Shapefiles with ARCSHAPE command in Environmental Systems Research Institute (ESRI) GIS software.

Purpose:

These data sets are intended to support watershed analysis in BASINS.

Time Period of Content:

Time Period Information:
Range of Dates/Times:
Beginning Date: Unknown
Ending Date: Unknown
Currentness Reference: publication date

Spatial Reference Information

Horizontal Coordinate System Definition:
Geographic:
Latitude Resolution: 0.0001
Longitude Resolution: 0.0001
Geographic Coordinate Units: Decimal Degrees
Geodetic Model:
Horizontal Datum Name: North American Datum of 1983
Ellipsoid Name: Geodetic Reference System 80
Semi-major Axis: 6378137
Denominator of Flattening Ratio: 298.257

Hydrologic Basins (Hydrologic Sub-units)

	Citation Information
Title:	Hydrologic Basins
Originator:	Teale GIS Soltuions Group
Publication Date:	1997-01-01
Other Citation Details:	This is NAD 27 datum in Albers projection. Measurment unit in meters. Captured by manual digitizing.
	Identification Information
Abstract:	The coverage hbasa2 was prepared by the California department of Fish and Game (DFG) as a task within an interagency agreement for geographic information system (GIS) support to the California State Water Resources Control Board (SWRCB) Non-Point Source (NPS) Unit. Hbasa2 is a statewide version of the Teale GIS Technology Center (Teale) County Library data layer for hydrologic basins, called hbasa. DFG performed various corrections to the original data, such as basin coding, sliver polygon removal, and digitizing of missing boundaries. The intended use of hbasa2 is as an interim reference in digital form, accurately (but not precisely) corresponding to SWRCB-delineated basins, and as a cross-reference to Department of Water Resources (DWR) basin codes as presented in the Areal Designation map of February 10, 1981 and in "Hydrologic Data", Bulletin 130-85 (DWR, May 1988).
Purpose:	To provide information about hydrologic data to the public.
Time Period:	Start: 1997-01-01 End: 1997-12-31
Currentness:	Publication Date
Progress:	Complete
Update Frequency:	As Needed
Places:	Place Name of Bounding Box: Channel Islands National Park Other Place Names: Channel Islands National Park
Geographic Region:	West: -119.2300 East: -119.2300 North: 34.0000 South: 34.0000
Themes:	Physical Geography, Water resources,
Access Limitations:	*No Restrictions*
Use Limitations:	*No Redistribution*
Data Contact:	Metadata Administrator
	Distribution Information
Online Link:	http://gis.ca.gov/casil/gis.ca.gov/teale/hbasa2/

Metadata Information	
Date:	1997-12-24

National Hydrography Dataset CA SWRCB

Citation Information	
Title:	National Hydrography Dataset CA SWRCB
Originator:	U.S. Geological Survey in cooperation with U.S. Environmental Pr
Publication Date:	*Unknown*

Identification Information	
Abstract:	The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that comprise the nations surface water drainage system. It is based initially on the content of the U.S. Geological Survey 1:100,000-scale Digital Line Graph (DLG) hydrography data, integrated with reach-related information from the U.S. Environmental Protection Agency Reach File Version 3.0 (RF3). More specifically, it contains reach codes for networked features and isolated lakes, flow direction, names, stream level, and centerline representations for areal water bodies. Reaches are also defined to represent waterbodies and the approximate shorelines of the Great Lakes, the Atlantic and Pacific Oceans, and the Gulf of Mexico. The NHD also incorporates the National Spatial Data Infrastructure framework criteria set out by the Federal Geographic Data Committee.
Purpose:	The National Hydrography Dataset combines elements of the DLG and RF3: spatial accuracy and comprehensiveness from the DLG and network relationships, names, stream level, and a unique identifier (reach code) for surface water features from RF3. The NHD supersedes DLG and RF3 by incorporating them, not by replacing them. Users of DLG and RF3 will find the National Hydrography Dataset both familiar and greatly expanded and refined. The NHD provides a national framework for assigning reach addresses to water-related entities, such as industrial dischargers, drinking water supplies, fish habitat areas, wild and scenic rivers. Reach addresses establish the locations of these entities relative to one another within the NHD surface water drainage network in a manner similar to street addresses. Once linked to the NHD by their reach addresses, the upstream/downstream relationships of these water-related entities and any associated information about them can be analyzed using software tools ranging from spreadsheets to geographic information systems (GIS). GIS can also be used to combine NHD-based network analysis with other data layers, such as soils, land use and population, to help better understand and display their respective effects upon one another. Furthermore, because the NHD provides a nationally consistent framework for addressing and analysis, water-related information linked to reach addresses by one organization (national, state, local) can be shared with other organizations and easily integrated into many different types of applications to the benefit of all. The National Hydrography Dataset is designed to provide comprehensive coverage of hydrologic data for the U.S. While initially based on 1:100,000-scale data, the NHD is designed to incorporate - and encourage the development of - higher-resolution data required by many users. It will facilitate the improved integration of water-related data in support of the application requirements of a growing national user community and will enable shared maintenance and enhancement.
Time Period:	Start: 0000-00-00 End: 0000-00-00
Currentness:	Unknown
Progress:	Unknown
Update Frequency:	Unknown
Geographic Region:	West: 0.0000 East: 0.0000 North: 0.0000 South: 0.0000
Themes:	Physical Geography, Artificial Path, Spring / Seep, Lake / Pond, Swamp / Marsh, Canal / Ditch, Reservoir, Stream / River, Hydrography
Access Limitations:	*No Restrictions*
Use Limitations:	*Educational Only*
Data Contact:	Fiona Renton

Distribution Information	
Online Link:	*SWRCB Region 3 HPBA ():* http://gis.ca.gov/casil/swrcb.ca.gov/nhd_r3_1.0.tar.gz *SWRCB Region 4 HPBA ():* http://gis.ca.gov/casil/swrcb.ca.gov/nhd_r4_1.0.tar.gz *SWRCB Region 5 HPBA (tl):* http://gis.ca.gov/casil/swrcb.ca.gov/nhd_r5_ti_1.0.tar.gz *SWRCB Region 6 HPBA (sl):* http://gis.ca.gov/casil/swrcb.ca.gov/nhd_r6_sl_1.0.tar.gz *SWRCB Region 7 HPBA ():* http://gis.ca.gov/casil/swrcb.ca.gov/nhd_r7_1.0.tar.gz *SWRCB Region 8 HPBA ():* http://gis.ca.gov/casil/swrcb.ca.gov/nhd_r8_1.0.tar.gz *SWRCB Region 9 HPBA ():* http://gis.ca.gov/casil/swrcb.ca.gov/nhd_r9_1.0.tar.gz

Metadata Information	
Date:	0000-00-00
Metadata Contact:	Fiona Renton

11. APPENDIX B. CITIES BY SCAG COUNTY

Imperial	Los Angeles	Los Angeles (con.t)	Orange	Riverside	San Bernardino	Ventura
Brawley	Agoura Hills	Monterey Park	Aliso Viejo	Banning	Adelanto	Camarillo
Calexico	Alhambra	Norwalk	Anaheim	Beaumont	Apple Valley	Fillmore
Calipatria	Arcadia	Palmdale	Brea	Blythe	Barstow	Moorpark
El Centro	Artesia	Palos Verdes Estates	Buena Park	Calimesa	Big Bear Lake	Ojai
Holtville	Avalon	Paramount	Costa Mesa	Canyon Lake	Chino	Oxnard
Imperial	Azusa	Pasadena	Cypress	Cathedral City	Chino Hills	Port Hueneme
Westmorland	Baldwin Park	Pico Rivera	Dana Point	Coachella	Colton	San Buenaventura
	Bell	Pomona	Fountain Valley	Corona	Fontana	Santa Paula
	Bellflower	Rancho Palos Verdes	Fullerton	Desert Hot Springs	Grand Terrace	Simi Valley
	Bell Gardens	Redondo Beach	Garden Grove	Hemet	Hesperia	Thousand Oaks
	Beverly Hills	Rolling Hills	Huntington Beach	Indian Wells	Highland	
	Bradbury	Rolling Hills Estates	Irvine	Indio	Loma Linda	
	Burbank	Rosemead	Laguna Beach	Lake Elsinore	Montclair	
	Calabasas	San Dimas	Laguna Hills	La Quinta	Needles	
	Carson	San Fernando	Laguna Niguel	Moreno Valley	Ontario	
	Cerritos	San Gabriel	Laguna Woods	Murrieta	Rancho Cucamonga	
	Claremont	San Marino	La Habra	Norco	Redlands	
	Commerce	Santa Clarita	Lake Forest	Palm Desert	Rialto	
	Compton	Santa Fe Springs	La Palma	Palm Springs	San Bernardino	
	Covina	Santa Monica	Los Alamitos	Perris	Twentynine Palms	
	Cudahy	Sierra Madre	Mission Viejo	Rancho Mirage	Upland	
	Culver City	Signal Hill	Newport Beach	Riverside	Victorville	
	Diamond Bar	South El Monte	Orange	San Jacinto	Yucaipa	
	Downey	South Gate	Placentia	Temecula	Yucca Valley	
	Duarte	South Pasadena	Rancho Santa Margarita			
	El Monte	Temple City	San Clemente			
	El Segundo	Torrance	San Juan Capistrano			
	Gardena	Vernon	Santa Ana			
	Glendale	Walnut	Seal Beach			
	Glendora	West Covina	Stanton			
	Hawaiian Gardens	West Hollywood	Tustin			
	Hawthorne	Westlake Village	Villa Park			
	Hermosa Beach	Whittier	Westminster			
	Hidden Hills		Yorba Linda			
	Huntington Park					
	Industry					
	Inglewood					
	Irwindale					
	La Canada Flintridge					
	La Habra Heights					
	Lakewood					
	La Mirada					
	Lancaster					
	La Puente					
	La Verne					
	Lawndale					
	Lomita					
	Long Beach					
	Los Angeles					
	Lynwood					
	Malibu					
	Manhattan Beach					
	Maywood					

Imperial	Los Angeles	Los Angeles (con.t)	Orange	Riverside	San Bernardino	Ventura
	Monrovia					
	Montebello					

12. APPENDIX C. CITIES WITHIN SCAG AREA AND CORRESPONDING WATERSHEDS

City ID based on SCAG classification. Watershed Hydrologic Unit Code (HUC) based on USGS classification.

City ID	City Name	Watersheds	HUC
0	Brawley	Salton Sea	18100200
1	Calexico	Salton Sea	18100200
2	Calipatria	Salton Sea	18100200
3	El Centro	Salton Sea	18100200
4	Holtville	Salton Sea	18100200
5	Imperial	Salton Sea	18100200
6	Westmorland	Salton Sea	18100200
7	Camarillo	Calleguas	18070103
8	Fillmore	Santa Clara	18070102
9	Moorpark	Calleguas	18070103
10	Ojai	Ventura	18070101
11	Oxnard	Santa Clara	18070102
		Calleguas	18070103
12	Port Hueneme	Calleguas	18070103
13	San Buenaventura	Ventura	18070101
		Santa Clara	18070102
14	Santa Paula	Santa Clara	18070102
15	Simi Valley	Calleguas	18070103
		Los Angeles	18070105
16	Thousand Oaks	Calleguas	18070103
		Santa Monica Bay	18070104
17	Adelanto	Mojave	18090208
18	Apple Valley	Mojave	18090208
19	Barstow	Mojave	18090208
20	Big Bear Lake	Santa Ana	18070203
21	Chino	Santa Ana	18070203
22	Chino Hills	San Gabriel	18070106
		Santa Ana	18070203
23	Colton	Santa Ana	18070203
24	Fontana	Santa Ana	18070203
25	Grand Terrace	Santa Ana	18070203
26	Hesperia	Mojave	18090208
27	Highland	Santa Ana	18070203
28	Loma Linda	Santa Ana	18070203
29	Montclair	Santa Ana	18070203
30	Needles	Havasu-Mohave Lakes	15030101
		Piute Wash	15030102
31	Ontario	Santa Ana	18070203

City ID	City Name	Watersheds	HUC
32	Rancho Cucamonga	Santa Ana	18070203
33	Redlands	Santa Ana	18070203
34	Rialto	Santa Ana	18070203
35	San Bernardino	Santa Ana	18070203
36	Twentynine Palms	Southern Mojave	18100100
37	Upland	Santa Ana	18070203
38	Victorville	Mojave	18090208
39	Yucaipa	Santa Ana	18070203
40	Yucca Valley	Southern Mojave	18100100
		Salton Sea	18100200
41	Agoura Hills	Santa Monica Bay	18070104
42	Alhambra	Los Angeles	18070105
43	Arcadia	Los Angeles	18070105
		San Gabriel	18070106
44	Artesia	San Gabriel	18070106
45	Avalon	San Pedro Channel Islands	18070107
46	Azusa	San Gabriel	18070106
47	Baldwin Park	San Gabriel	18070106
48	Bell	Los Angeles	18070105
49	Bell Gardens	Los Angeles	18070105
50	Bellflower	Los Angeles	18070105
		San Gabriel	18070106
51	Beverly Hills	Santa Monica Bay	18070104
52	Bradbury	Los Angeles	18070105
		San Gabriel	18070106
53	Burbank	Los Angeles	18070105
54	Calabasas	Santa Monica Bay	18070104
54	Calabasas	Los Angeles	18070105
55	Carson	Santa Monica Bay	18070104
		Los Angeles	18070105
56	Cerritos	San Gabriel	18070106
57	Claremont	San Gabriel	18070106
		Santa Ana	18070203
58	Commerce	Los Angeles	18070105
59	Compton	Santa Monica Bay	18070104
		Los Angeles	18070105
60	Covina	San Gabriel	18070106
61	Cudahy	Los Angeles	18070105
62	Culver City	Santa Monica Bay	18070104
63	Diamond Bar	San Gabriel	18070106
		Santa Ana	18070203
64	Downey	Los Angeles	18070105
		San Gabriel	18070106
65	Duarte	Los Angeles	18070105
		San Gabriel	18070106
66	El Monte	Los Angeles	18070105

City ID	City Name	Watersheds	HUC
		San Gabriel	18070106
67	El Segundo	Santa Monica Bay	18070104
68	Gardena	Santa Monica Bay	18070104
69	Glendale	Los Angeles	18070105
70	Glendora	San Gabriel	18070106
71	Hawaiian Gardens	San Gabriel	18070106
72	Hawthorne	Santa Monica Bay	18070104
73	Hermosa Beach	Santa Monica Bay	18070104
74	Hidden Hills	Santa Monica Bay	18070104
		Los Angeles	18070105
75	Huntington Park	Los Angeles	18070105
76	Industry	San Gabriel	18070106
77	Inglewood	Santa Monica Bay	18070104
78	Irwindale	Los Angeles	18070105
		San Gabriel	18070106
79	La Canada-Flntrdg	Los Angeles	18070105
80	La Habra Heights	San Gabriel	18070106
81	La Mirada	San Gabriel	18070106
82	La Puente	San Gabriel	18070106
83	La Verne	San Gabriel	18070106
84	Lakewood	San Gabriel	18070106
85	Lancaster	Antelope-Fremont Valleys	18090206
86	Lawndale	Santa Monica Bay	18070104
87	Lomita	Santa Monica Bay	18070104
88	Long Beach	Santa Monica Bay	18070104
		San Gabriel	18070106
89	Los Angeles	Calleguas	18070103
		Los Angeles	18070105
90	Lynwood	Los Angeles	18070105
91	Malibu	Santa Monica Bay	18070104
92	Manhattan Beach	Santa Monica Bay	18070104
93	Maywood	Los Angeles	18070105
94	Monrovia	Los Angeles	18070105
		San Gabriel	18070106
95	Montebello	Los Angeles	18070105
96	Monterey Park	Los Angeles	18070105
97	Norwalk	San Gabriel	18070106
98	Palmdale	Santa Clara	18070102
		Antelope-Fremont Valleys	18090206
99	Palos Verdes Est	Santa Monica Bay	18070104
100	Paramount	Los Angeles	18070105
		San Gabriel	18070106
101	Pasadena	Los Angeles	18070105
102	Pico Rivera	Los Angeles	18070105
		San Gabriel	18070106
103	Pomona	San Gabriel	18070106

City ID	City Name	Watersheds	HUC
		Santa Ana	18070203
104	Rancho Palos Vrds	Santa Monica Bay	18070104
105	Redondo Beach	Santa Monica Bay	18070104
106	Rolling Hills	Santa Monica Bay	18070104
107	Rolling Hills Est	Santa Monica Bay	18070104
108	Rosemead	Los Angeles	18070105
109	San Dimas	San Gabriel	18070106
110	San Fernando	Los Angeles	18070105
111	San Gabriel	Los Angeles	18070105
112	San Marino	Los Angeles	18070105
113	Santa Clarita	Santa Clara	18070102
		Los Angeles	18070105
114	Santa Fe Springs	San Gabriel	18070106
115	Santa Monica	Santa Monica Bay	18070104
116	Sierra Madre	Los Angeles	18070105
117	Signal Hill	Los Angeles	18070105
		San Gabriel	18070106
118	South El Monte	Los Angeles	18070105
		San Gabriel	18070106
119	South Gate	Los Angeles	18070105
120	South Pasadena	Los Angeles	18070105
121	Temple City	Los Angeles	18070105
122	Torrance	Santa Monica Bay	18070104
123	Vernon	Los Angeles	18070105
124	Walnut	San Gabriel	18070106
125	West Covina	San Gabriel	18070106
126	West Hollywood	Santa Monica Bay	18070104
127	Westlake Village	Santa Monica Bay	18070104
128	Whittier	San Gabriel	18070106
129	Aliso Viejo	Newport Bay	18070204
		Aliso-San Onofre	18070301
130	Anaheim	San Gabriel	18070106
		Seal Beach	18070201
		Santa Ana	18070203
131	Brea	San Gabriel	18070106
132	Buena Park	San Gabriel	18070106
		Seal Beach	18070201
133	Costa Mesa	Santa Ana	18070203
		Newport Bay	18070204
134	Cypress	San Gabriel	18070106
		Seal Beach	18070201
135	Dana Point	Aliso-San Onofre	18070301
136	Fountain Valley	Seal Beach	18070201
		Santa Ana	18070203
137	Fullerton	San Gabriel	18070106
138	Garden Grove	San Gabriel	18070106

City ID	City Name	Watersheds	HUC
		Seal Beach	18070201
		Santa Ana	18070203
139	Huntington Beach	Seal Beach	18070201
		Santa Ana	18070203
140	Irvine	Newport Bay	18070204
141	La Habra	San Gabriel	18070106
142	La Palma	San Gabriel	18070106
143	Laguna Beach	Aliso-San Onofre	18070301
144	Laguna Hills	Newport Bay	18070204
		Aliso-San Onofre	18070301
145	Laguna Niguel	Aliso-San Onofre	18070301
146	Laguna Woods	Newport Bay	18070204
		Aliso-San Onofre	18070301
147	Lake Forest	Newport Bay	18070204
		Aliso-San Onofre	18070301
148	Los Alamitos	San Gabriel	18070106
		Seal Beach	18070201
149	Mission Viejo	Aliso-San Onofre	18070301
150	Newport Beach	Santa Ana	18070203
		Newport Bay	18070204
		Aliso-San Onofre	18070301
151	Orange	Seal Beach	18070201
		Santa Ana	18070203
		Newport Bay	18070204
152	Placentia	San Gabriel	18070106
153	Rancho Santa Margarita	Aliso-San Onofre	18070301
154	San Clemente	Aliso-San Onofre	18070301
155	San Juan Capistrano	Aliso-San Onofre	18070301
156	Santa Ana	Seal Beach	18070201
		Santa Ana	18070203
		Newport Bay	18070204
157	Seal Beach	San Gabriel	18070106
		Seal Beach	18070201
158	Stanton	Seal Beach	18070201
159	Tustin	Newport Bay	18070204
160	Villa Park	Santa Ana	18070203
161	Westminster	Seal Beach	18070201
162	Yorba Linda	San Gabriel	18070106
		Santa Ana	18070203
163	Banning	San Jacinto	18070202
		Santa Ana	18070203
		Salton Sea	18100200
164	Beaumont	San Jacinto	18070202
		Santa Ana	18070203
165	Blythe	Imperial Reservoir	15030104
		Southern Mojave	18100100

City ID	City Name	Watersheds	HUC
166	Calimesa	Santa Ana	18070203
167	Canyon Lake	San Jacinto	18070202
168	Cathedral City	Salton Sea	18100200
169	Coachella	Salton Sea	18100200
170	Corona	Santa Ana	18070203
171	Desert Hot Springs	Salton Sea	18100200
172	Hemet	San Jacinto	18070202
		Santa Margarita	18070302
173	Indian Wells	Salton Sea	18100200
174	Indio	Salton Sea	18100200
175	La Quinta	Salton Sea	18100200
176	Lake Elsinore	San Jacinto	18070202
		Santa Ana	18070203
177	Moreno Valley	San Jacinto	18070202
		Santa Ana	18070203
178	Murrieta	San Jacinto	18070202
		Santa Margarita	18070302
179	Norco	Santa Ana	18070203
180	Palm Desert	Salton Sea	18100200
181	Palm Springs	Salton Sea	18100200
182	Perris	San Jacinto	18070202
183	Rancho Mirage	Salton Sea	18100200
184	Riverside	San Jacinto	18070202
		Santa Ana	18070203
185	San Jacinto	San Jacinto	18070202
186	Temecula	Santa Margarita	18070302

13. APPENDIX D. HYDROLOGIC UNITS BY SCAG COUNTY

County	Watershed	HUC
Imperial	Imperial Reservoir	15030104
	Lower Colorado	15030107
	Salton Sea	18100200
	Southern Mojave	18100100
Los Angeles	Antelope-Fremont Valleys	18090206
	Calleguas	18070103
	Dominguez Channel	(HSU)
	Los Angeles	18070105
	Los Cerritos Channel	(HSU)
	Middle Kern-Upper Tehachapi-Grapevine	18030003
	Mojave	18090208
	San Gabriel	18070106
	San Pedro Channel Islands	18070107
	Santa Ana	18070203
	Santa Clara	18070102
	Santa Monica Bay	18070104
Orange	Aliso-San Onofre	18070301
	Newport Bay	18070204
	San Gabriel	18070106
	San Jacinto	18070202
	Santa Ana	18070203
	Seal Beach	18070201
Riverside	Aliso-San Onofre	18070301
	Imperial Reservoir	15030104
	Salton Sea	18100200
	San Jacinto	18070202
	San Luis Rey-Escondido	18070303
	Santa Ana	18070203
	Santa Margarita	18070302
	Southern Mojave	18100100
San Bernardino	Antelope-Fremont Valleys	18090206
	Coyote-Cuddeback Lakes	18090207
	Death Valley-Lower Amargosa	18090203
	Havasu-Mohave Lakes	15030101
	Imperial Reservoir	15030104
	Indian Wells-Searles Valleys	18090205
	Ivanpah-Pahrump Valleys	16060015
	Mojave	18090208
	Panamint Valley	18090204
	Piute Wash	15030102
	Salton Sea	18100200
	San Gabriel	18070106
	Santa Ana	18070203

County	Watershed	HUC
	Southern Mojave	18100100
	Upper Amargosa	18090202
Ventura	Calleguas	18070103
	Cuyama	18060007
	Los Angeles	18070105
	Middle Kern-Upper Tehachapi-Grapevine	18030003
	Santa Barbara Channel Islands	18060014
	Santa Barbara Coastal	18060013
	Santa Clara	18070102
	Santa Monica Bay	18070104
	Santa Ynez	18060010
	Ventura	18070101

14. APPENDIX E. HYDROLOGIC SUB-UNITS BY SCAG COUNTY

Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura
715.4	403.41	405.12	708.1	405.43	312.3
715.5	403.42	405.15	709.1	405.62	314.51
717.1	403.43	405.62	709.2	405.63	315.34
719.47	403.51	801.11	711	481.21	401
721	403.52	801.12	712	481.22	402.1
722.2	403.53	801.13	715.1	481.23	402.2
722.61	403.54	801.25	715.2	609.11	402.31
723.1	403.55	801.31	715.3	609.13	402.32
723.2	403.66	801.34	715.4	609.21	403.11
724	403.67	802.31	715.5	609.22	403.12
726	404.11	845.61	716	609.23	403.21
727	404.12	845.62	717.1	609.24	403.22
728	404.13	845.63	717.2	609.42	403.31
	404.14	901.11	717.3	609.44	403.32
	404.15	901.12	717.4	610	403.41
	404.16	901.13	718	611	403.42
	404.21	901.14	719.1	612	403.43
	404.22	901.2	719.2	613.1	403.44
	404.23	901.3	719.31	613.2	403.51
	404.24	901.4	719.32	614	403.61
	404.25		719.41	615.1	403.62
	404.26		719.42	615.2	403.63
	404.31		719.43	616	403.64
	404.32		719.44	617	403.65
	404.33		719.45	618	403.66
	404.34		719.46	619	403.67
	404.35		719.47	620.1	403.68
	404.36		720	620.6	404.22
	404.37		721	620.7	404.23
	404.41		722.11	620.8	404.25
	404.42		722.12	621.1	404.26
	404.43		722.13	621.2	404.44
	404.44		723.1	621.3	404.45
	404.45		725	624.2	404.46
	405.11		728	625.4	404.47
	405.12		801.12	626.5	404.48
	405.13		801.13	626.6	405.21
	405.14		801.21	626.8	406.1
	405.15		801.25	627	406.2
	405.21		801.26	628.1	406.3
	405.22		801.27	628.2	556.3
	405.23		801.31	628.3	
	405.24		801.32	628.41	
	405.25		801.33	628.42	
	405.31		801.34	628.5	
	405.32		801.35	628.61	
	405.33		801.45	628.62	
	405.41		801.61	628.71	
	405.42		801.62	628.72	
	405.43		801.63	628.73	
	405.44		801.64	628.81	
	405.51		801.67	628.82	
	405.52		801.69	628.9	
	405.53		802.11	629	
	405.62		802.12	701	
	405.63		802.13	702	
	406.4		802.14	703	
	406.5		802.15	704	
	481.21		802.21	705	
	481.22		802.22	706	
	481.23		802.23	707	
	556.3		802.31	708.1	
	626.4		802.32	708.2	
	626.5		901.2	709.1	
	626.7		901.4	709.2	

Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura
	626.8		**902.21**	**710.1**	
	628.1		**902.22**	**710.2**	
	801.21		**902.23**	**711**	
	845.61		**902.31**	**712**	
	845.62		**902.32**	**713.1**	
	845.63		**902.33**	**713.2**	
			902.34	**713.3**	
			902.35	**713.4**	
			902.36	**714**	
			902.41	**715.1**	
			902.42	**716**	
			902.43	**717.3**	
			902.44	**719.1**	
			902.51	**719.32**	
			902.52	**719.41**	
			902.61	**719.42**	
			902.62	**719.43**	
			902.63	**719.44**	
			902.71	**801.13**	
			902.72	**801.21**	
			902.73	**801.23**	
			902.74	**801.24**	
			902.81	**801.27**	
			902.82	**801.41**	
			902.83	**801.42**	
			902.84	**801.43**	
			902.91	**801.44**	
			902.92	**801.45**	
				801.51	
				801.52	
				801.53	
				801.54	
				801.55	
				801.56	
				801.57	
				801.58	
				801.59	
				801.61	
				801.62	
				801.64	
				801.65	
				801.66	
				801.67	
				801.68	
				801.69	
				801.71	
				801.72	
				801.73	
				845.62	
				845.63	

15. APPENDIX F. CORRESPONDENCE BETWEEN HYDROLOGIC SUB-UNITS AND CITIES

NHCODE	City
628.2	Adelanto
404.22	Agoura Hills
404.23	Agoura Hills
404.24	Agoura Hills
404.25	Agoura Hills
405.41	Alhambra
801.11	Aliso Viejo
901.12	Aliso Viejo
901.13	Aliso Viejo
801.11	Anaheim
801.12	Anaheim
801.13	Anaheim
845.61	Anaheim
845.63	Anaheim
628.2	Apple Valley
628.3	Apple Valley
405.31	Arcadia
405.33	Arcadia
405.41	Arcadia
405.15	Artesia
406.4	Avalon
405.41	Azusa
405.42	Azusa
405.43	Azusa
405.41	Baldwin Park
719.31	Banning
719.32	Banning
801.69	Banning
802.21	Banning
628.3	Barstow
628.5	Barstow
719.31	Beaumont
801.62	Beaumont
801.63	Beaumont
802.21	Beaumont
405.15	Bell
405.15	Bell Gardens
405.15	Bellflower
405.13	Beverly Hills
405.14	Beverly Hills
405.15	Beverly Hills
801.71	Big Bear Lake

NHCODE	City
801.73	Big Bear Lake
715.4	Blythe
717.1	Blythe
405.41	Bradbury
723.1	Brawley
405.62	Brea
845.62	Brea
845.63	Brea
405.15	Buena Park
845.61	Buena Park
405.21	Burbank
404.11	Calabasas
404.21	Calabasas
404.22	Calabasas
405.21	Calabasas
723.1	Calexico
801.61	Calimesa
801.62	Calimesa
801.63	Calimesa
801.64	Calimesa
801.67	Calimesa
801.69	Calimesa
723.1	Calipatria
403.11	Camarillo
403.12	Camarillo
403.61	Camarillo
403.63	Camarillo
403.64	Camarillo
802.11	Canyon Lake
802.12	Canyon Lake
405.12	Carson
405.15	Carson
719.41	Cathedral City
719.42	Cathedral City
719.46	Cathedral City
719.47	Cathedral City
405.15	Cerritos
481.21	Chino
801.21	Chino
405.62	Chino Hills
405.63	Chino Hills
481.21	Chino Hills
801.13	Chino Hills
801.21	Chino Hills
845.62	Chino Hills
845.63	Chino Hills

NHCODE	City
405.52	Claremont
405.53	Claremont
481.21	Claremont
481.22	Claremont
481.23	Claremont
719.45	Coachella
719.47	Coachella
801.27	Colton
801.44	Colton
801.45	Colton
801.52	Colton
405.15	Commerce
405.12	Compton
405.15	Compton
801.13	Corona
801.21	Corona
801.25	Corona
801.26	Corona
801.32	Corona
801.11	Costa Mesa
405.41	Covina
405.15	Cudahy
405.12	Culver City
405.13	Culver City
405.15	Culver City
405.15	Cypress
801.11	Cypress
845.61	Cypress
901.14	Dana Point
901.2	Dana Point
901.3	Dana Point
719.42	Desert Hot Springs
719.43	Desert Hot Springs
405.41	Diamond Bar
405.51	Diamond Bar
405.62	Diamond Bar
481.21	Diamond Bar
845.62	Diamond Bar
405.15	Downey
405.41	Duarte
405.42	Duarte
405.43	Duarte
723.1	El Centro
405.41	El Monte
405.12	El Segundo
403.31	Fillmore

NHCODE	City
801.21	Fontana
801.27	Fontana
801.42	Fontana
801.43	Fontana
801.44	Fontana
801.11	Fountain Valley
405.15	Fullerton
845.61	Fullerton
845.62	Fullerton
845.63	Fullerton
801.11	Garden Grove
845.61	Garden Grove
405.12	Gardena
405.15	Glendale
405.21	Glendale
405.24	Glendale
405.25	Glendale
405.31	Glendale
405.32	Glendale
405.41	Glendora
405.42	Glendora
405.43	Glendora
405.44	Glendora
801.27	Grand Terrace
801.44	Grand Terrace
801.45	Grand Terrace
405.15	Hawaiian Gardens
405.12	Hawthorne
802.13	Hemet
802.15	Hemet
802.21	Hemet
902.36	Hemet
405.12	Hermosa Beach
628.2	Hesperia
404.22	Hidden Hills
405.21	Hidden Hills
801.52	Highland
801.57	Highland
801.58	Highland
723.1	Holtville
801.11	Huntington Beach
405.15	Huntington Park
723.1	Imperial
719.47	Indian Wells
719.45	Indio
719.46	Indio

NHCODE	City
719.47	Indio
405.15	Industry
405.41	Industry
405.62	Industry
405.12	Inglewood
405.15	Inglewood
801.11	Irvine
901.12	Irvine
405.41	Irwindale
405.42	Irwindale
405.21	La Canada-Flntrdg
405.24	La Canada-Flntrdg
405.31	La Canada-Flntrdg
405.32	La Canada-Flntrdg
405.15	La Habra
845.61	La Habra
845.62	La Habra
405.15	La Habra Heights
405.41	La Habra Heights
405.62	La Habra Heights
845.62	La Habra Heights
405.15	La Mirada
845.61	La Mirada
405.15	La Palma
845.61	La Palma
405.41	La Puente
719.47	La Quinta
405.41	La Verne
405.44	La Verne
405.52	La Verne
405.53	La Verne
901.11	Laguna Beach
901.12	Laguna Beach
901.13	Laguna Beach
901.14	Laguna Beach
801.11	Laguna Hills
901.13	Laguna Hills
901.2	Laguna Hills
901.13	Laguna Niguel
901.14	Laguna Niguel
901.2	Laguna Niguel
801.11	Laguna Woods
901.12	Laguna Woods
901.13	Laguna Woods
801.34	Lake Elsinore
801.35	Lake Elsinore

NHCODE	City
802.11	Lake Elsinore
802.12	Lake Elsinore
802.31	Lake Elsinore
802.32	Lake Elsinore
801.11	Lake Forest
801.12	Lake Forest
901.13	Lake Forest
405.15	Lakewood
626.5	Lancaster
405.12	Lawndale
801.44	Loma Linda
801.45	Loma Linda
801.52	Loma Linda
801.53	Loma Linda
801.62	Loma Linda
405.12	Lomita
405.12	Long Beach
405.15	Long Beach
845.61	Long Beach
405.15	Los Alamitos
801.11	Los Alamitos
845.61	Los Alamitos
404.11	Los Angeles
405.11	Los Angeles
405.12	Los Angeles
405.13	Los Angeles
405.14	Los Angeles
405.15	Los Angeles
405.21	Los Angeles
405.22	Los Angeles
405.23	Los Angeles
405.24	Los Angeles
405.25	Los Angeles
405.41	Los Angeles
405.15	Lynwood
404.12	Malibu
404.13	Malibu
404.14	Malibu
404.15	Malibu
404.16	Malibu
404.21	Malibu
404.31	Malibu
404.32	Malibu
404.33	Malibu
404.34	Malibu
404.35	Malibu

NHCODE	City
404.36	Malibu
404.37	Malibu
404.41	Malibu
404.42	Malibu
404.43	Malibu
404.44	Malibu
405.12	Manhattan Beach
405.15	Maywood
901.13	Mission Viejo
901.2	Mission Viejo
405.33	Monrovia
405.41	Monrovia
405.43	Monrovia
481.21	Montclair
801.21	Montclair
405.15	Montebello
405.41	Montebello
405.15	Monterey Park
405.41	Monterey Park
403.62	Moorpark
403.63	Moorpark
403.65	Moorpark
801.27	Moreno Valley
801.45	Moreno Valley
802.11	Moreno Valley
802.21	Moreno Valley
802.12	Murrieta
902.31	Murrieta
902.32	Murrieta
902.33	Murrieta
902.42	Murrieta
713.1	Needles
713.3	Needles
801.11	Newport Beach
901.11	Newport Beach
801.21	Norco
801.25	Norco
801.26	Norco
405.15	Norwalk
402.2	Ojai
402.32	Ojai
801.21	Ontario
801.11	Orange
801.12	Orange
801.13	Orange
403.11	Oxnard

NHCODE	City
719.47	Palm Desert
719.41	Palm Springs
719.42	Palm Springs
719.47	Palm Springs
403.53	Palmdale
403.54	Palmdale
403.55	Palmdale
626.5	Palmdale
626.7	Palmdale
626.8	Palmdale
405.11	Palos Verdes Est
405.12	Palos Verdes Est
405.15	Paramount
405.15	Pasadena
405.25	Pasadena
405.31	Pasadena
405.32	Pasadena
405.41	Pasadena
802.11	Perris
802.12	Perris
405.15	Pico Rivera
405.41	Pico Rivera
845.61	Placentia
845.63	Placentia
405.41	Pomona
405.51	Pomona
405.52	Pomona
481.21	Pomona
481.22	Pomona
801.21	Pomona
403.11	Port Hueneme
801.21	Rancho Cucamonga
801.24	Rancho Cucamonga
719.47	Rancho Mirage
405.11	Rancho Palos Vrds
405.12	Rancho Palos Vrds
901.13	Rancho Santa Margarita
901.2	Rancho Santa Margarita
801.45	Redlands
801.52	Redlands
801.53	Redlands
801.54	Redlands
801.55	Redlands
801.56	Redlands
801.58	Redlands
801.61	Redlands

NHCODE	City
801.62	Redlands
405.12	Redondo Beach
801.21	Rialto
801.27	Rialto
801.42	Rialto
801.43	Rialto
801.44	Rialto
801.52	Rialto
801.59	Rialto
801.21	Riverside
801.25	Riverside
801.26	Riverside
801.27	Riverside
802.11	Riverside
405.11	Rolling Hills
405.12	Rolling Hills
405.11	Rolling Hills Est
405.12	Rolling Hills Est
405.15	Rosemead
405.41	Rosemead
801.44	San Bernardino
801.52	San Bernardino
801.59	San Bernardino
401	San Buenaventura
402.1	San Buenaventura
402.2	San Buenaventura
403.11	San Buenaventura
403.21	San Buenaventura
901.2	San Clemente
901.3	San Clemente
901.4	San Clemente
405.41	San Dimas
405.44	San Dimas
405.51	San Dimas
405.52	San Dimas
405.21	San Fernando
405.22	San Fernando
405.41	San Gabriel
802.15	San Jacinto
802.21	San Jacinto
901.2	San Juan Capistrano
901.3	San Juan Capistrano
405.31	San Marino
405.41	San Marino
801.11	Santa Ana
403.51	Santa Clarita

NHCODE	City
405.21	Santa Clarita
405.15	Santa Fe Springs
405.13	Santa Monica
403.21	Santa Paula
405.12	Seal Beach
405.15	Seal Beach
801.11	Seal Beach
845.61	Seal Beach
405.31	Sierra Madre
405.33	Sierra Madre
405.41	Sierra Madre
405.12	Signal Hill
405.15	Signal Hill
403.62	Simi Valley
403.65	Simi Valley
403.67	Simi Valley
403.68	Simi Valley
404.22	Simi Valley
404.23	Simi Valley
405.21	Simi Valley
405.41	South El Monte
405.15	South Gate
405.15	South Pasadena
405.31	South Pasadena
405.41	South Pasadena
801.11	Stanton
845.61	Stanton
902.32	Temecula
902.33	Temecula
902.42	Temecula
902.51	Temecula
902.52	Temecula
405.41	Temple City
403.12	Thousand Oaks
403.63	Thousand Oaks
403.64	Thousand Oaks
403.65	Thousand Oaks
403.67	Thousand Oaks
403.68	Thousand Oaks
404.23	Thousand Oaks
404.25	Thousand Oaks
404.26	Thousand Oaks
404.47	Thousand Oaks
405.11	Torrance
405.12	Torrance
801.11	Tustin

NHCODE	City
709.1	Twentynine Palms
709.2	Twentynine Palms
481.21	Upland
481.22	Upland
481.23	Upland
801.21	Upland
801.23	Upland
801.24	Upland
405.15	Vernon
628.2	Victorville
801.11	Villa Park
405.41	Walnut
405.51	Walnut
405.41	West Covina
405.14	West Hollywood
405.15	West Hollywood
404.23	Westlake Village
404.24	Westlake Village
404.25	Westlake Village
404.26	Westlake Village
404.37	Westlake Village
801.11	Westminster
723.1	Westmorland
405.15	Whittier
405.41	Whittier
801.13	Yorba Linda
845.63	Yorba Linda
801.56	Yucaipa
801.58	Yucaipa
801.61	Yucaipa
801.64	Yucaipa
801.65	Yucaipa
801.66	Yucaipa
801.67	Yucaipa
801.68	Yucaipa
801.69	Yucaipa
705	Yucca Valley
708.1	Yucca Valley
708.2	Yucca Valley
719.1	Yucca Valley
719.43	Yucca Valley

16. APPENDIX G. RTP PROJECTS SORTED BY COUNTY

County	RTP ID	Route/Program	From	To	Description	Watershed	Sub-watersheds (HSU)
Los Angeles	1H0101	SR-14	Ave. P-8	Ave. L	Add 1 HOV lane each dir	18090206	626.5
Los Angeles	1H0102	I-5/SR-170	North to South/South to North	-	HOV Connector	18070105	405.21
Los Angeles	1H0103	I-5/I-405	North to South/South to North	-	HOV Connector	18070105	405.21
Los Angeles	1M0171	Gerald Desmond Bridge replacement	-	-	Replacement of existing bridge connecting Terminal Island to I-710	18070104	405.12
Orange	2H01143	I-5 NB/SB	Coast Highway	Pico	Add 1 HOV lane each direction	18070301	901.2, 901.3
Orange	2H01145	I-405/I-605	-	-	HOV Connector	18070106	845.61
Orange	2H01148	I-405	Von Karman	-	HOV Drop Ramp	18070204	801.11
Orange	2M01117	SR-57 NB	Orangethorpe	Lambert	MF or Aux Capacity	18070106	845.61, 845.62, 845.63
Orange	2M01118	SR-57 NB	at SR-91		Add 4th through lane	18070106	845.61
Orange	2M01124	SR-91 EB/WB	Truck scales	Imperial	Add storage lane at truck weigh in motion station	18070203	801.11, 801.13
Orange	2M04121	SR-91 EB/WB	SR-55	Riverside County Line	Add 1 MF lane each direction	18070203	801.11, 801.13
Orange	2M04132A	I-405	SR-73	Beach	Add 1 MF lane each direction	18070201, 18070203	801.11
Orange	2T01135	SR-91/SR-241	-	-	Add direct toll-to-toll or HOV connection from north/south SR-241 to SR-91 toll lanes to/from the east	18070203	801.13
Orange	2T04136	SR-91	SR-241	SR-71	Add toll lane and toll connection at SR-71 (RIV) (per Four Corners Study)	18070203	801.13
Orange	2TK01116	SR-57 NB	Lambert	Tonner Canyon Road	Truck Climbing Lane	18070106	845.62
Orange	ORA000193	SR-22/I-405	-	-	HOV Connector	18070201	801.11
Riverside	3A01MA01	SR-79	Ramona Expwy	Domenigoni Parkway	Realign highway (construct 4 lanes)	18070202	802.13, 802.15,802.21, 902.33, 902.35
Riverside	3A04SH12	SR-79	Hunter	Ramona Expwy	Widen from 4 to 6 lanes (note: RTIP#46460 widens to 6 lanes from Hunter to Domenigoni)	18070202	802.13, 802.15,802.21, 902.33, 902.35
Riverside	3C01MA01	CETAP - Cajalco/Ramona	Hemet	Corona/Lake Elsinore	Cajalco/Ramona expressway (3 lanes each dir) from Sanderson Ave to I-15	18070203	801.32,801.33, 802.11,802.14, 802.15, 802.21
Riverside	3H01SH03	SR-60/I-215	SR60/I-215	East to SR-	HOV Connector	18070203	801.27

County	RTP ID	Route/Program	From	To	Description	Watershed	Sub-watersheds (HSU)
			E. Jct	60 and South to I-215			
Riverside	3M01MA06	I-15	San Diego County Line (R0.0)	SR-60 (51.5)	Add 1 HOV lane each direction (EA's 33790G, 33800G)	18070202, 18070203, 18070302	801.21,801.25, 801.32,801.34, 801.35,802.31, 902.31,902.31, 902.32,902.33, 902.42, 902.52
Riverside	3M01MA07	I-215	Eucalyptus Ave (R37.4)	I-15 (R8.9)	Add 1 MF lane each direction (EA's 35380K, 35390K, 35370K)	18070202, 18070203, 18070302	801.27, 802.11, 802.12, 902.32, 902.33
Riverside	3M01MA08	I-215	SR-60/SR-91/I-215 Jct	San Bernardino County Line	Add 1 MF and 1 HOV lane each direction (EA 467200)	18070203	801.27
Riverside	3M01MA09	SR-71	SR-91	San Bernardino County Line	Widen to 3 MF lanes each direction	18070203	801.13, 801.21, 801.25
Riverside	3M01SH06	I-10	Monterey Ave (44.5)	Dillon Rd (58.9)	Add 1 MF lane each direction (EA 0A030K)	18100200	719.47
Riverside	3M04MA05	I-10/SR-60	-	-	Construct new interchange	18070203	801.62
Riverside	3M04MA10	SR-91	Pierce Street	Orange County Line	Add 1 MF lane each direction	18070203	801.13, 801.25, 801.26
Riverside	3M04MA11	SR-91/I-15	South to West/West to South	-	HOV Connector	18070203	801.25
Riverside	3TK04MA12	I-10	San Bernardino County Line (R0.0)	Banning City Limits (12.9)	Add eastbound truck climbing lane	18070202, 18070203	801.62, 801.63, 801.67, 802.21
Riverside	3TK04MA13	SR-60	Badlands area east of Moreno Valley	Badlands area - west of SR-60/I-10 Jct	Add eastbound truck climbing lane	18070202, 18070203	801.62, 802.21
San Bernardino	4A01900	SR-18	Los Angeles County Line	US 395	Widen from 1 to 2 lanes each dir	18090206, 18090208	626.8, 628.1, 628.2
San Bernardino	4H01001	I-10	I-15	SR-38	Add 1 HOV lane each direction, widen UC's, reconstruct ramps	18070203	801.21, 801.27, 801.44, 801.52, 801.53
San Bernardino	4H01002	I-10	SR-38	Yucaipa Bl	Add 1 HOV lane each direction	18070203	801.53, 801.55, 801.56, 801.61
San Bernardino	4H01003	I-10	Yucaipa Bl	Riverside County Line	Add 1 HOV lane each direction	18070203	801.61, 801.64, 801.67
San	4H01004	I-15	Riverside	I-215	Add 1 HOV lane each direction	18070203	801.21,801.42,

County	RTP ID	Route/Program	From	To	Description	Watershed	Sub-watersheds (HSU)
Bernardino			County Line				801.43, 801.52, 801.59
San Bernardino	4H01005	I-15	I-215	US-395	Add 1 HOV lane each direction	18070203, 18090208	628.2, 801.51, 801.52
San Bernardino	4H01006	I-15	US-395	D St	Add 1 HOV lane each direction	18090208	628.2
San Bernardino	4H01007	I-215	Riverside County Line	I-10	Add 1 HOV lane each direction	18070203	801.27, 801.44
San Bernardino	4H01008	I-215	SR-30	I-15	Add 1 HOV lane each direction	18070203	801.52
San Bernardino	4H01009	I-10/I-215	South to East/East to South	-	HOV Connector	18070203	801.44
San Bernardino	4H01010	I-10/I-15	South to West/West to South	-	HOV Connector	18070203	801.21
San Bernardino	4H01011	I-10/I-15	North to West/West to North	-	HOV Connector	18070203	801.21
San Bernardino	4M01003	I-215	SR-30	I-15	Add 1 MF lane each direction	18070203	801.52
San Bernardino	4M01005	SR-210	I-215	I-10	Add 1 MF lane each direction and widen UC's	18070203	801.52
San Bernardino	4M04001	I-215	Riverside County Line	I-10	Add 1 MF lane each direction	18070203	801.27, 801.44
San Bernardino	4M04200	I-10 WB	Yucaipa Bl	Ford St	Add 1 MF lane westbound	18070203	801.55, 801.56
San Bernardino	4T01003	I-15	Devore	Summit	Truck Climbing Lane	18070203, 18090208	628.2, 801.51, 801.52
Ventura	5A0101	SR-33	Foster Park	Creek Rd	Expressway	18070101	402.1, 402.2
Ventura	5A0103	SR-118	SR-232	Moorpark	Expressway	18070102, 18070103	403.11,403.12, 403.61, 403.62
Imperial	6M01003	SR-111	SR-98	I-8	Upgrade to 4-lane freeway with interchange(s) at several locations	18100200	723.1
Imperial	6M01004	SR-111	SR-78 (Brawley)	SR-115 (Calipatria)	Upgrade to 4-lane conventional	18100200	723.1
Imperial	6M0400E	SR-115	I-8	Evan Hewes Hwy	Construct 4-lane extension	18100200	723.1
Imperial	6M04018	Dogwood Rd Corridor / I-8 Overpass	SR-98	I-8	Corridor improvements - widen to 6 lanes from McCabe to I-8; I-8 improvement to 6 lanes	18100200	723.1

17. APPENDIX H. ESTIMATED RUNOFF AND POLLUTANT LOADS FROM RTP PROJECTS

Assumed concentrations based on CTSW-RT-03-065.51.42 (Table 3-2, median values) :

DOC	TDS	TOC	TSS	Oil & Grease	TPH (diesel)	TPH (Heavy oil)
mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
13.1	60.3	15.3	59.1	1.44	2.52	1.4

RTP ID	Length	Added Width	Estimated Area +25%	Estimated Annual Precip	Estimated Runoff	DOC load	TDS load	TOC load	TSS load	Oil & Grease load	TPH (diesel) load	TPH (heavy oil) load
	(km)	(m)	(m^2)	(m)	(m^3/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)
3M01MA06	83.3	15	104,140	0.34	35,894	470	2,164	549	2,121	52	90	50
3C01MA01	52.0	92	65,092	0.33	21,399	280	1,290	327	1,265	31	54	30
3M01MA07	45.6	15	57,015	0.30	17,253	226	1,040	264	1,020	25	43	24
4H01001	33.6	15	42,015	0.40	17,011	223	1,026	260	1,005	24	43	24
3A04SH12	32.9	62	41,187	0.31	12,945	170	781	198	765	19	33	18
5A0103	26.6	92	33,342	0.42	14,091	185	850	216	833	20	36	20
4H01004	26.2	15	32,765	0.70	23,042	302	1,389	353	1,362	33	58	32
4H01005	26.1	15	32,640	0.70	22,955	301	1,384	351	1,357	33	58	32
4A01900	24.1	15	30,140	0.22	6,695	88	404	102	396	10	17	9
3M01SH06	23.0	15	28,765	0.11	3,131	41	189	48	185	5	8	4
4T01003	21.9	8	27,383	0.70	19,257	252	1,161	295	1,138	28	49	27
3A01MA01	20.0	62	25,062	0.34	8,611	113	519	132	509	12	22	12
4H01006	18.9	15	23,640	0.39	9,326	122	562	143	551	13	24	13
4M01005	18.1	15	22,640	0.39	8,836	116	533	135	522	13	22	12
3M04MA10	17.8	15	22,265	0.08	1,725	23	104	26	102	2	4	2
6M01004	16.6	62	20,812	0.00	0	0	0	0	0	0	0	0
2M04121	15.3	15	19,140	0.40	7,719	101	465	118	456	11	19	11
3TK04MA12	14.9	15	18,640	0.45	8,359	110	504	128	494	12	21	12
4M01003	12.4	15	15,515	0.65	10,019	131	604	153	592	14	25	14
4H01008	12.3	15	15,390	0.65	9,938	130	599	152	587	14	25	14

RTP ID	Length	Added Width	Estimated Area +25%	Estimated Annual Precip	Estimated Runoff	DOC load	TDS load	TOC load	TSS load	Oil & Grease load	TPH (diesel) load	TPH (heavy oil) load
	(km)	(m)	(m^2)	(m)	(m^3/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)
3TK04MA13	11.7	15	14,640	0.45	6,566	86	396	100	388	9	17	9
6M01003	10.6	62	13,312	0.07	975	13	59	15	58	1	2	1
6M04018	10.5	62	13,187	0.07	969	13	58	15	57	1	2	1
2M04132A	10.1	15	12,640	0.33	4,192	55	253	64	248	6	11	6
1H0101	8.0	15	10,015	0.19	1,932	25	117	30	114	3	5	3
4H01002	7.4	15	9,265	0.35	3,261	43	197	50	193	5	8	5
2M01117	7.2	15	9,015	0.36	3,259	43	197	50	193	5	8	5
3M01MA08	7.0	15	8,765	0.29	2,499	33	151	38	148	4	6	3
4H01007	6.5	15	8,140	0.31	2,551	33	154	39	151	4	6	4
4M04001	6.5	15	8,140	0.31	2,551	33	154	39	151	4	6	4
4H01003	5.9	15	7,390	0.49	3,600	47	217	55	213	5	9	5
2H01143	5.5	15	6,890	0.41	2,794	37	168	43	165	4	7	4
5A0101	5.0	92	6,342	0.32	1,999	26	121	31	118	3	5	3
3M01MA09	4.8	15	6,015	0.08	453	6	27	7	27	1	1	1
6M0400E	4.4	62	5,562	0.42	2,328	30	140	36	138	3	6	3
4M04200	3.8	8	4,758	0.39	1,839	24	111	28	109	3	5	3
2TK01116	1.5	8	1,883	0.44	825	11	50	13	49	1.2	2.1	1.2
2M01118	1.0	15	1,265	0.35	448	6	27	7	26	0.6	1.1	0.6
2M01124	0.7	15	890	0.40	359	5	22	5	21	0.5	0.9	0.5

Assumed concentrations based on CTSW-RT-03-065.51.42 (Table 3-2, median values) :

	As (tot)	Cd (tot)	Cr (tot)	Cu (tot)	Hg (tot)	Ni (tot)	Pb (tot)	Zn (tot)	Fecal coliform MPN/100 mL	NH3-N	NO3-N	P (tot)	TKN	Diazinon	Diuron	Glyphosate	Pyrene
	ug/L	ug/L	ug/L	ug/L	ng/L	ug/L	ug/L	ug/L		mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L
	1.1	0.44	5.8	21.1	26	7.7	12.7	111.2	362	0.77	0.6	0.18	1.4	0.04	0.37	8.88	0.05

RTP ID	As (tot) load	Cd (tot) load	Cr (tot) load	Cu (tot) load	Hg (tot) load	Ni (tot) load	Pb (tot) load	Zn (tot) load	Fecal coliform load	NH3-N load	NO3-N load	P (tot) load	TKN load	Diazinon load	Diuron load	Glyphosate load	Pyrene load
	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)
3M01MA06	0.039	0.016	0.208	0.757	9.E-04	0.276	0.456	3.991	12,994	27.6	21.5	6.5	50.3	1.E-03	1.E-02	3.E-01	2.E-03
3C01MA01	0.024	0.009	0.124	0.452	6.E-04	0.165	0.272	2.380	7,746	16.5	12.8	3.9	30.0	9.E-04	8.E-03	2.E-01	1.E-03
3M01MA07	0.019	0.008	0.100	0.364	4.E-04	0.133	0.219	1.919	6,246	13.3	10.4	3.1	24.2	7.E-04	6.E-03	2.E-01	9.E-04
4H01001	0.019	0.007	0.099	0.359	4.E-04	0.131	0.216	1.892	6,158	13.1	10.2	3.1	23.8	7.E-04	6.E-03	2.E-01	9.E-04
3A04SH12	0.014	0.006	0.075	0.273	3.E-04	0.100	0.164	1.439	4,686	10.0	7.8	2.3	18.1	5.E-04	5.E-03	1.E-01	6.E-04
5A0103	0.015	0.006	0.082	0.297	4.E-04	0.108	0.179	1.567	5,101	10.8	8.5	2.5	19.7	6.E-04	5.E-03	1.E-01	7.E-04
4H01004	0.025	0.010	0.134	0.486	6.E-04	0.177	0.293	2.562	8,341	17.7	13.8	4.1	32.3	9.E-04	9.E-03	2.E-01	1.E-03
4H01005	0.025	0.010	0.133	0.484	6.E-04	0.177	0.292	2.553	8,310	17.7	13.8	4.1	32.1	9.E-04	8.E-03	2.E-01	1.E-03
4A01900	0.007	0.003	0.039	0.141	2.E-04	0.052	0.085	0.745	2,424	5.2	4.0	1.2	9.4	3.E-04	2.E-03	6.E-02	3.E-04
3M01SH06	0.003	0.001	0.018	0.066	8.E-05	0.024	0.040	0.348	1,133	2.4	1.9	0.6	4.4	1.E-04	1.E-03	3.E-02	2.E-04
4T01003	0.021	0.008	0.112	0.406	5.E-04	0.148	0.245	2.141	6,971	14.8	11.6	3.5	27.0	8.E-04	7.E-03	2.E-01	1.E-03
3A01MA01	0.009	0.004	0.050	0.182	2.E-04	0.066	0.109	0.958	3,117	6.6	5.2	1.6	12.1	3.E-04	3.E-03	8.E-02	4.E-04
4H01006	0.010	0.004	0.054	0.197	2.E-04	0.072	0.118	1.037	3,376	7.2	5.6	1.7	13.1	4.E-04	3.E-03	8.E-02	5.E-04
4M01005	0.010	0.004	0.051	0.186	2.E-04	0.068	0.112	0.983	3,199	6.8	5.3	1.6	12.4	4.E-04	3.E-03	8.E-02	4.E-04
3M04MA10	0.002	0.001	0.010	0.036	4.E-05	0.013	0.022	0.192	624	1.3	1.0	0.3	2.4	7.E-05	6.E-04	2.E-02	9.E-05
6M01004	0.000	0.000	0.000	0.000	0.E+00	0.000	0.000	0.000	0	0.0	0.0	0.0	0.0	0.E+00	0.E+00	0.E+00	0.E+00
2M04121	0.008	0.003	0.045	0.163	2.E-04	0.059	0.098	0.858	2,794	5.9	4.6	1.4	10.8	3.E-04	3.E-03	7.E-02	4.E-04
3TK04MA12	0.009	0.004	0.048	0.176	2.E-04	0.064	0.106	0.930	3,026	6.4	5.0	1.5	11.7	3.E-04	3.E-03	7.E-02	4.E-04
4M01003	0.011	0.004	0.058	0.211	3.E-04	0.077	0.127	1.114	3,627	7.7	6.0	1.8	14.0	4.E-04	4.E-03	9.E-02	5.E-04
4H01008	0.011	0.004	0.058	0.210	3.E-04	0.077	0.126	1.105	3,598	7.7	6.0	1.8	13.9	4.E-04	4.E-03	9.E-02	5.E-04
3TK04MA13	0.007	0.003	0.038	0.139	2.E-04	0.051	0.083	0.730	2,377	5.1	3.9	1.2	9.2	3.E-04	2.E-03	6.E-02	3.E-04
6M01003	0.001	0.000	0.006	0.021	3.E-05	0.008	0.012	0.108	353	0.8	0.6	0.2	1.4	4.E-05	4.E-04	9.E-03	5.E-05

RTP ID	As (tot) load	Cd (tot) load	Cr (tot) load	Cu (tot) load	Hg (tot) load	Ni (tot) load	Pb (tot) load	Zn (tot) load	Fecal coliform load	NH3-N load	NO3-N load	P (tot) load	TKN load	Diazinon load	Diuron load	Glyphosate load	Pyrene load
	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)
6M04018	0.001	0.000	0.006	0.020	3.E-05	0.007	0.012	0.108	351	0.7	0.6	0.2	1.4	4.E-05	4.E-04	9.E-03	5.E-05
2M04132A	0.005	0.002	0.024	0.088	1.E-04	0.032	0.053	0.466	1,517	3.2	2.5	0.8	5.9	2.E-04	2.E-03	4.E-02	2.E-04
1H0101	0.002	0.001	0.011	0.041	5.E-05	0.015	0.025	0.215	699	1.5	1.2	0.3	2.7	8.E-05	7.E-04	2.E-02	1.E-04
4H01002	0.004	0.001	0.019	0.069	8.E-05	0.025	0.041	0.363	1,180	2.5	2.0	0.6	4.6	1.E-04	1.E-03	3.E-02	2.E-04
2M01117	0.004	0.001	0.019	0.069	8.E-05	0.025	0.041	0.362	1,180	2.5	2.0	0.6	4.6	1.E-04	1.E-03	3.E-02	2.E-04
3M01MA08	0.003	0.001	0.014	0.053	6.E-05	0.019	0.032	0.278	904	1.9	1.5	0.4	3.5	1.E-04	9.E-04	2.E-02	1.E-04
4H01007	0.003	0.001	0.015	0.054	7.E-05	0.020	0.032	0.284	923	2.0	1.5	0.5	3.6	1.E-04	9.E-04	2.E-02	1.E-04
4M04001	0.003	0.001	0.015	0.054	7.E-05	0.020	0.032	0.284	923	2.0	1.5	0.5	3.6	1.E-04	9.E-04	2.E-02	1.E-04
4H01003	0.004	0.002	0.021	0.076	9.E-05	0.028	0.046	0.400	1,303	2.8	2.2	0.6	5.0	1.E-04	1.E-03	3.E-02	2.E-04
2H01143	0.003	0.001	0.016	0.059	7.E-05	0.022	0.035	0.311	1,011	2.2	1.7	0.5	3.9	1.E-04	1.E-03	2.E-02	1.E-04
5A0101	0.002	0.001	0.012	0.042	5.E-05	0.015	0.025	0.222	724	1.5	1.2	0.4	2.8	8.E-05	7.E-04	2.E-02	1.E-04
3M01MA09	0.000	0.000	0.003	0.010	1.E-05	0.003	0.006	0.050	164	0.3	0.3	0.1	0.6	2.E-05	2.E-04	4.E-03	2.E-05
6M0400E	0.003	0.001	0.014	0.049	6.E-05	0.018	0.030	0.259	843	1.8	1.4	0.4	3.3	9.E-05	9.E-04	2.E-02	1.E-04
4M04200	0.002	0.001	0.011	0.039	5.E-05	0.014	0.023	0.204	666	1.4	1.1	0.3	2.6	7.E-05	7.E-04	2.E-02	9.E-05
2TK01116	0.001	0.000	0.005	0.017	2.E-05	0.006	0.010	0.092	299	0.6	0.5	0.1	1.2	3.E-05	3.E-04	7.E-03	4.E-05
2M01118	0.000	0.000	0.003	0.009	1.E-05	0.003	0.006	0.050	162	0.3	0.3	0.1	0.6	2.E-05	2.E-04	4.E-03	2.E-05
2M01124	0.000	0.000	0.002	0.008	9.E-06	0.003	0.005	0.040	130	0.3	0.2	0.1	0.5	1.E-05	1.E-04	3.E-03	2.E-05

18. APPENDIX I. FLOOD RISK ZONE FOR RTP PROJECTS

County	RTP ID	Route/Program	Description	Estimated Runoff (m3/yr)	Estimated Runoff (ac/yr)	Flood Risk Zone
Riverside	3M04MA10	SR-91	Add 1 MF lane each direction	8,836	7.16	A
Orange	2M04121	SR-91 EB/WB	Add 1 MF lane each direction	7,719	6.26	A
Orange	2M04132A	I-405	Add 1 MF lane each direction	4,192	3.40	A
Riverside	3M01MA09	SR-71	Widen to 3 MF lanes each direction	2,328	1.89	A
Orange	2M01124	SR-91 EB/WB	Add storage lane at truck weigh in motion station	359	0.29	A
Los Angeles	1M0171	Gerald Desmond Bridge replacement	Replacement of existing bridge connecting Terminal Island to I-710	251	0.20	A
Orange	2T01135	SR-91/SR-241	Add direct toll-to-toll or HOV connection from north/south SR-241 to SR-91 toll lanes to/from the east	224	0.18	A
Orange	2H01145	I-405/I-605	HOV Connector	213	0.17	A
San Bernardino	4H01004	I-15	Add 1 HOV lane each direction	23,042	18.68	A,D
San Bernardino	4H01001	I-10	Add 1 HOV lane each direction, widen UC's, reconstruct ramps	17,011	13.79	A,D
San Bernardino	4M01003	I-215	Add 1 MF lane each direction	10,019	8.12	A,D
San Bernardino	4H01008	I-215	Add 1 HOV lane each direction	9,938	8.06	A,D
San Bernardino	4M01005	SR-210	Add 1 MF lane each direction and widen UC's	9,326	7.56	A,D
San Bernardino	4H01002	I-10	Add 1 HOV lane each direction	3,261	2.64	A,D
Riverside	3C01MA01	CETAP - Cajalco/Ramona	Cajalco/Ramona expressway (3 lanes each dir) from Sanderson Ave to I-15	21,399	17.35	A,D,X
Riverside	3M01MA07	I-215	Add 1 MF lane each direction (EA's 35380K, 35390K, 35370K)	17,253	13.99	A,D,X
Riverside	3A04SH12	SR-79	Widen from 4 to 6 lanes (note: RTIP#46460 widens to 6 lanes from Hunter to Domenigoni)	12,945	10.49	A,D,X
Riverside	3TK04MA12	I-10	Add eastbound truck climbing lane	8,359	6.78	A,D,X
Riverside	3A01MA01	SR-79	Realign highway (construct 4 lanes)	6,541	5.30	A,D,X
San Bernardino	4H01003	I-10	Add 1 HOV lane each direction	2,794	2.26	A,D,X
San Bernardino	4M04001	I-215	Add 1 MF lane each direction	2,551	2.07	A,D,X
Orange	2T04136	SR-91	Add toll lane and toll connection at SR-71 (RIV) (per Four Corners Study)	431	0.35	A,D,X
Riverside	3M01MA06	I-15	Add 1 HOV lane each direction (EA's 33790G, 33800G)	35,894		29.10
Ventura	5A0103	SR-118	Expressway	14,091	11.42	A,X

County	RTP ID	Route/Program	Description	Estimated Runoff (m3/yr)	Estimated Runoff (ac/yr)	Flood Risk Zone
Ventura	5A0101	SR-33	Expressway	3,600	2.92	A,X
San Bernardino	4H01007	I-215	Add 1 HOV lane each direction	2,551	2.07	A,X
Riverside	3M01MA08	I-215	Add 1 MF and 1 HOV lane each direction (EA 467200)	2,499	2.03	A,X
Los Angeles	1H0101	SR-14	Add 1 HOV lane each dir	1,932	1.57	A,X
Imperial	6M01004	SR-111	Upgrade to 4-lane conventional	1,725	1.40	A,X
Imperial	6M0400E	SR-115	Construct 4-lane extension	453	0.37	A,X
Riverside	3M01SH06	I-10	Add 1 MF lane each direction (EA 0A030K)	3,131	2.54	A,X,X500
San Bernardino	4H01005	I-15	Add 1 HOV lane each direction	22,955	18.61	D
San Bernardino	4T01003	I-15	Truck Climbing Lane	19,257	15.61	D
Riverside	3H01SH03	SR-60/I-215	HOV Connector	222	0.18	D
San Bernardino	4A01900	SR-18	Widen from 1 to 2 lanes each dir	6,695	5.43	D,X
Riverside	3TK04MA13	SR-60	Add eastbound truck climbing lane	6,566	5.32	D,X
San Bernardino	4M04200	I-10 WB	Add 1 MF lane westbound	1,839	1.49	D,X
San Bernardino	4H01006	I-15	Add 1 HOV lane each direction	8,611	6.98	X
Orange	2H01143	I-5 NB/SB	Add 1 HOV lane each direction	1,999	1.62	X
Imperial	6M01003	SR-111	Upgrade to 4-lane freeway with interchange(s) at several locations	975	0.79	X
Imperial	6M04018	Dogwood Rd Corridor / I-8 Overpass	Corridor improvements - widen to 6 lanes from McCabe to I-8; I-8 improvement to 6 lanes	969	0.79	X
Orange	2TK01116	SR-57 NB	Truck Climbing Lane	825	0.67	X
Orange	2H01148	I-405	HOV Drop Ramp	213	0.17	X
Los Angeles	1H0102	I-5/SR-170	HOV Connector	130	0.11	X
Los Angeles	1H0103	I-5/I-405	HOV Connector	130	0.11	X
Orange	2M01117	SR-57 NB	MF or Aux Capacity	3,259	2.64	X,X500
Orange	2M01118	SR-57 NB	Add 4th through lane	448	0.36	X500
Orange	ORA000193	SR-22/I-405	HOV Connector	47	0.04	X500
San Bernardino	4H01009	I-10/I-215	HOV Connector	436	0.35	?
San Bernardino	4H01010	I-10/I-15	HOV Connector	436	0.35	?
San Bernardino	4H01011	I-10/I-15	HOV Connector	436	0.35	?
Riverside	3M04MA11	SR-91/I-15	HOV Connector	263	0.21	?
Riverside	3M04MA05	I-10/SR-60	Construct new interchange	73	0.06	?

19. APPENDIX J. POTENTIAL PARTNERS FOR RTP PROJECT ACTIONS

County	RTP ID	Cities & Counties					
Imperial	6M01003	Imperial County	Calexico				
Imperial	6M01004	Calipatria	Brawley	Imperial County			
Imperial	6M0400E	Imperial County					
Imperial	6M04018	Imperial County	El Centro				
Los Angeles	1H0101	Lancaster	Palmdale				
Los Angeles	1H0102	Los Angeles					
Los Angeles	1H0103	Los Angeles					
Los Angeles	1M0171	Long Beach					
Orange	2H01143	San Clemente	Dana Point	San Juan Capistrano			
Orange	2H01145	Seal Beach	Long Beach				
Orange	2H01148	Irvine					
Orange	2M01117	Placentia	Fullerton	Brea	Orange County		
Orange	2M01118	Anaheim					
Orange	2M01124	Anaheim	Yorba Linda				
Orange	2M04121	Anaheim	Yorba Linda				
Orange	2M04132A	Westminster	Huntington Beach	Fountain Valley	Costa Mesa		
Orange	2T01135	Anaheim	Yorba Linda				
Orange	2T04136	Anaheim	Yorba Linda				
Orange	2TK01116	Anaheim					
Orange	ORA000193	Westminster	Seal Beach	Garden Grove			
Riverside	3A01MA01						
Riverside	3A04SH12	San Jacinto	Hemet	Riverside County	Murreta		
Riverside	3C01MA01	Riverside County	Corona	Perris	San Jacinto		
Riverside	3H01SH03	Moreno Valley					
Riverside	3M01MA06	Corona	Lake Elsinore	Riverside County	Murreta	Temecula	Norco
Riverside	3M01MA07	Riverside	Perris	Riverside County	Murreta		
Riverside	3M01MA08	Riverside					
Riverside	3M01MA09	Riverside County					

County	RTP ID	Cities & Counties							
Riverside	3M01SH06	Palm Desert	Indio	Coachella	Riverside County				
Riverside	3M04MA05	Beaumont							
Riverside	3M04MA10	Corona	Riverside	Riverside County					
Riverside	3M04MA11	Corona							
Riverside	3TK04MA12	Beaumont	Calimesa						
Riverside	3TK04MA13	Riverside County	Beaumont						
San Bernardino	4A01900	San Bernardino County	Adelanto	Hesperia					
San Bernardino	4H01001	Ontario	Fontana	Rialto	Colton	San Bernardino County	Loma Linda	San Bernardino	**Redlands**
San Bernardino	4H01002	Redlands							
San Bernardino	4H01003	Yucaipa							
San Bernardino	4H01004	Ontario	Rancho Cucamonga	San Bernardino County					
San Bernardino	4H01005	San Bernardino County							
San Bernardino	4H01006	Hesperia	Victorville						
San Bernardino	4H01007	Colton	Grand Terrace						
San Bernardino	4H01008	San Bernardino County	San Bernardino						
San Bernardino	4H01009	Colton							
San Bernardino	4H01010	Ontario							
San Bernardino	4H01011	Ontario							
San Bernardino	4M01003	San Bernardino County	San Bernardino						
San Bernardino	4M01005	Redlands	Highland	San Bernardino					
San Bernardino	4M04001	Colton	Grand Terrace						
San Bernardino	4M04200	Redlands	Yucaipa						
San Bernardino	4T01003	San Bernardino County	San Bernardino						
Ventura	5A0101	Ventura County							
Ventura	5A0103	Moor Park	Ventura County						

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